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# USSR Report

CONSTRUCTION AND EQUIPMENT

No. 65



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## CONSTRUCTION

### GOSSTROY OFFICIAL REVIEWS PAST FEATS, FUTURE TASKS FOR CONSTRUCTION

Moscow STROITEL' in Russian No 12, Dec 81 (signed to press 20 Nov 81) pp 4-7

[Article by Aleksey Dmitriyevich Deminov, first deputy chairman of USSR Gosstroy: "On the Threshold of the Second Year of the Five-Year Plan"]

[Text] As a result of the labor and political uplift provoked by 26th CPSU Congress decisions and by the socialist competition that was promoted widely during the first half of 1981, further growth of the country's economic potential has been assured and the people's welfare has been raised.

Fixed capital totaling 30.9 billion rubles, or 1.3 billion more than for the same period of last year, was put into operation for the national economy as a whole.

State capital investment in the national economy was about 53 billion rubles, and it grew by 4 percent in comparison with the first half of 1980.

Builders of heavy-industry enterprises carried out their plan for the first half year for the introduction into operation of capacity for producing the basic types of industrial products.

In all, under the plan for introducing into operation during January-June 40 production facilities and items of capacity from the list in the State Plan for Economic and Social Development of the USSR, 42 were turned over for operation.

However, on the whole, the state of affairs in capital construction provokes great anxiety. The task for turning fixed capital over for operation through state capital investment during the first half of the year was realized in the amount of 30.9 billion rubles' worth, which did not exceed 80 percent of the plan.

Many construction organizations underfulfilled the goals for construction commodity output volume and growth in labor productivity.

At the November 1981 CPSU Central Committee Plenum the Politburo set a task: the 1982 plan should be not only fulfilled but overfulfilled. For this purpose, radical shifts must be made in capital construction practice in order to put production capacity into operation at all facilities called for by the plan, without exception.

"A feature of the drafts of the five-year plan and of the plan for 1982," Comrade L. I. Brezhnev noted at the plenum, "is that they call for a substantial increase

in the introduction of fixed capital into operation, at a time of reduced growth of capital investment. The CPSU Central Committee Politburo has sustained the government's proposal to reduce by 30 billion rubles the amount of capital investment and of construction and installing work that was originally contemplated by the five-year plan. What caused this?

"The available material and labor resources and the capacity of construction organizations have been considered, as well as the substantial amounts of uncompleted construction. In essence, right now there is a realistic, better-balanced plan for capital construction. This will create the conditions necessary for normal operation."

In answering with deeds the decisions of the 26th CPSU Congress and the sessions of the USSR Supreme Soviet of the 10th Convocation, workers of construction and of scientific-research and design institutes are striving to execute a most rapid turn to intensive methods of organizing capital construction and to raising work quality, based upon the achievements of construction science and technology.

USSR Gosstroy, jointly with the construction ministries, has worked out a specific integrated program for promoting science and technology in the areas of constructional structure, building materials, and construction machinery and mechanisms, and of the organization and technology of production. Ten scientific and technical programs for the design and construction of progressive types of apartment houses and industrial, agricultural and social buildings and structures, of new methods for urban development and for forming industrial clusters, of effective technical solutions for the erection of nuclear and other electric-power stations, railroad lines, highways and seaports, as well as of the creation of automated systems for controlling the branch, have been approved.

According to preliminary calculations, realization of the indicated programs will enable the consumption of rolled metal to be reduced by about 1 million tons and of cement by 1.8 million tons and labor expenditures to be greatly cut in 1985 in comparison with 1980.

Economical types of structure will be used at construction projects: coverings and diaphragms (metal); large-dimension thin-walled two- and three-dimensional reinforced-concrete structure; and structure made of high-strength and lightweight concretes. Centrifugally-cast columns, effective types of piles, reinforced-concrete pressure pipe, H- and I-beams, and high-strength reinforcement steel will find wide application.

Enormous work must be done to further improve the organization of construction and the execution of operations, the organization of work, and the mechanization of construction, and, based thereon, to achieve a systematic rise in labor productivity. Indeed, as is well known, all growth in construction and installing work volume in 1981-1985 should be obtained by raising labor productivity alone.

The following data testify to the existence of great unused reserves in this area. B. Moshtalerov's masons' brigade (Omsk, Trust No 2) achieved an average shift output of 3.4 m<sup>3</sup> of bricklaying per person, including all the concomitant work, V. Tsyarkin's brigade (Leningrad, Trust No 5) 3.0 m<sup>3</sup> and A. Yadyavichus's brigade (Vilnius, the Vilnius Construction Trust) 3.05 m<sup>3</sup>. These are high levels of output per person. For at many construction projects, output per person for laying

masonry where the labor-intensiveness is about the same does not exceed 1.2-1.5 m<sup>3</sup>. In the erection of apartment houses, A. Ivanov's brigade (Pskov DSK [housing construction combine]) reached a stable average output of 9.4 m<sup>2</sup> of useful space per person per shift. At the same time, at many construction projects, where labor intensiveness of the erecting work is identical, this indicator is 4-6 m<sup>2</sup>.

Such examples can also be cited for other types of work.

The construction ministries have analyzed the factors that influence the achievement of such high indicators. They are defined basically by three categories, which are regulated by the construction norms and regulations: effectiveness of the organization of construction, performance of the work, and organization of the work. It was established that, in organizations where brigades achieve high output per person:

the supplying of complete sets of operating equipment and the provisioning of a centralized control service have been introduced successfully;

maximum mechanization of construction processes is achieved;

the brigades labor in accordance with five-year, annual and monthly plans, under weekly and daily schedules;

the brigade contract is introduced in worker collectives;

brigades are supplied completely with the standard sets of tools, mechanisms and tooling;

the mandatory technology that is called for in the designs for performance of the work and in the flow charts has been introduced; and

the requirements of NOT [scientific organization of work] that have been set in the charts of the labor processes are being met.

One cannot remain silent about the fact that advanced workers use numerous technical improvements when doing various kinds of work, such as, for example, "stuffing" the next floor of an apartment house that is being erected with containers that contain the required sanitary-engineering equipment, ceramic tiles, parquetry staves, bundles of carpentry products, squared floor beams, and other items. And all this is transported by the mechanized method, by means of a crane, prior to the installation of the story's ceiling floors.

And the results of the introduction of all this are excellent. And if all brigades engaged in construction achieve even 60-80 percent of the output per person of the advanced brigades, labor productivity in construction as a whole will be raised by more than just one-tenth of a percent.

The advanced workers' experience is a systems approach to the matter, based upon a well-developed technology and strict observance of the plan and of operating and labor discipline.

However, not by far have all construction-project supervisors, engineers, technicians and brigades armed themselves for this style of work. And now would be the



time to act. This would lead to huge successes during the new, second year of the five-year plan.

Idle time within shifts and that caused by technical reasons still are great in construction. Eliminating them will enable construction-operations effectiveness to be raised by far. The Kaunas Housing Construction Combine is earnestly engaged in eliminating lost worktime. Each month here photographs are made of the builders' workday by specialty, the causes of idle time within shifts and of operating stoppages in brigades are discovered, and the potential for raising labor effectiveness is determined. The data obtained are analyzed, and then they are discussed at production meetings, and measures are taken to eliminate the deficiencies. As a result, worktime losses in the combine's construction brigades have been greatly reduced, and the builders' collectives are coping successfully with production tasks.

The introduction of new equipment and the mechanization of construction help to raise labor productivity, as is well known. These are the most important levers for raising construction-performance effectiveness. Each building organization has concrete tasks for introducing new equipment and for mechanizing construction and installing work.

It often happens that construction organizations have the same conditions for introducing new equipment, but the results are different. What is the matter? At construction projects of the Vladimir TUS, full prefabrication at industrial construction jobs has reached 96 percent, and, as a result, the economic effectiveness of introducing new equipment reaches more than 2 million rubles per year. Last year Glavivanovskstroy [Main Administration for Construction in Ivanovskaya Oblast] carried out only 10 of 21 projects for introducing new equipment. For practically the last 2 years labor productivity has not grown, and loss from the nonfulfillment of measures for introducing new equipment because of poor mechanization of the work was about 600,000 rubles for the past year. The main cause of such a great lag by Glavivanovskstroy builders is serious inadequacy in preparing for operations and in organizing construction. There is no real drive here to fulfill the plan to introduce new equipment, and plan, operating and labor discipline at the main administration's construction projects is low.

Such deficiencies occur in many construction organizations, including those at some places that still do not effectively operate services for equipment outfitting and centralized control.

USSR Gosstroy, Glavmosstroy [Main Administration for Housing and Nonindustrial Construction in the City of Moscow] and the VDNKh SSSR [USSR Exhibition of Achievements of the National Economy] recently held an All-Union school for the study of advanced experience in equipping construction facilities with complete sets of structure, materials and articles and also in the containerizing and transporting of freight to the job site. The school pointed out that in construction a definite system has been worked out at construction-industry enterprises to prepare numerous types of articles and semifinished items of the industrialized type and also to ready them for use on the job, and, moreover, experience has been gained in delivering items and materials in containers to facilities and to workplaces. What is the effectiveness of this whole system? The transfer of production processes (grading, selection, processing and making up complete sets) from construction sites to the factory environment and the mechanization of these processes help to

raise the sophistication of operations, the level of industrialization and the quality of construction, to reduce the labor intensiveness and cost of construction and to reduce materials consumption. Thus, the output of 10,000 meters of pipe per year with bituminous-perlite insulation at a Glavmosstroy production base enables labor costs for laying pipelines to be reduced by more than 20,000 mandays and 300,000 rubles to be saved. The centralized cutting and joining of linoleum carpeting enables costs for labor, stocking and making up complete sets for 10 million m<sup>2</sup> of wallpaper to be cut to a third and more than 100,000 rubles to be saved, and labor costs to be reduced substantially. The effectiveness is indisputable.

Then why is it that complete outfitting with equipment is not being introduced everywhere? For no great expenditures are required for this. There can be only one answer: certain construction organization supervisors underrate timely preparations for operations. However, an assiduous boss will always find a way. Construction organizations that do not have a permanent base for making up complete sets of equipment should, concurrently with formulation of solutions to questions of creating one and without postponing the matter or pigeonholing it, create the necessary base quickly, albeit a temporary one, that is intended to raise the technical level of supplying complete sets of equipment.

In order to become acquainted with advanced experience in the organization of outfitting with complete sets of equipment, it is recommended that a study be made of the system at Glavmosstroy, Glavleningradstroy [Main Administration for Housing, Nonindustrial and Industrial Construction under the Leningrad City Ispolkom] and Trust No 1 of Glavarkhangel'sstroy [Main Administration for Construction in Arkhangel'skaya Oblast], Uzbekshakhtostroy [Uzbek Underground-Mine Construction Trust], and many other construction organizations that have achieved successes in this area.

It is important, for purposes of increasing the effectiveness of outfitting with complete sets of equipment, to use the Vinnitsa method of outfitting for the consolidated brigade. This method, with the active operation of a centralized control service, which also spreads its influence to the brigades, will lead to high positive production results.

Centralized control of construction should be extended, as has already been said, to each brigade and should be based upon weekly and daily planning. This will confirm the advanced work experience of the collectives of such a well-known trust as the one at Lipetsk, and many others.

Mosoblstroy [Moscow Oblast Construction Trust] No 5 has achieved great effectiveness by introducing centralized control. For this purpose, a central operating and production control group (ODG) was established. Operations are performed here on the basis of weekly and daily planning. Approved weekly and daily schedules are transmitted for execution to the responsible doers of general contracting and subcontracting organizations. The ODG promotes precise fulfillment of the weekly and daily schedules. As a result of the introduction of weekly and daily planning and of centralized control in 1980 alone, one trust saved 256,000 rubles.

In construction, the role of operational-process documentation--designs for organizing construction and for performing the operations and flow charts--should be raised.



In construction there are standing rules that have proved themselves in practice: not one worker can be permitted to perform tasks without a check of his knowledge of work safety. Violation of these rules even involves strict punishment. So why are brigades being permitted in many cases to perform operations without a deep study and knowledge of the designs for doing the work, of the flow charts, and of the labor-processes chart? As a result, low levels of production and work quality are permitted.

At the 26th CPSU Congress Comrade L. I. Brezhnev pointed out the need to raise the responsibility of the doers in fulfilling approved plans. Plans should be well grounded and provided with resources. In construction, continuous planning, which permits construction collectives to prepare themselves in good time to fulfill the plan for the next month, quarter or year, is being introduced successfully.

The work experience of advanced construction collectives indicates that the introduction of continuous planning of the work of brigades under the five-year plan and under annual, quarterly and monthly plans, helps greatly to raise the effectiveness of their work. The work experience of the brigade of Hero of Socialist Labor and USSR State Prize Winner I. D. Ganchev is well-known throughout the whole country. This collective, working under that system, has been improving indicators of its work each year. During the last year of the Ninth Five-Year Plan the brigade assimilated 2.85 million rubles of investment at an average output of 6.76 m<sup>2</sup> of useful space per person per shift, and last year, with unchanged manning, the 36 men of the brigade assimilated 3.6 million rubles and achieved an output per person of almost 8 m<sup>2</sup>! In terms of prices, the brigade achieved an annual output per person of 100,000 rubles. There are many such "hundred-thousanders" in Moscow, the Ukraine, Krasnoyarskiy Kray, Irkutskaya Oblast and other places. The system of continuous planning must be disseminated widely in construction.

The especially effective method of organizing labor--the brigade contract, which was first applied by Hero of Socialist Labor N. A. Zlobin--has been propagated widely in construction.

"The Main Directions for the Economic and Social Development of the USSR During 1981-1985 and During the Period up to 1990" pointed to the need to lay the groundwork for disseminating everywhere the start-to-finish flow-line brigade contract, based upon a rise in the level of engineering preparation and on the provisioning of complete sets of production equipment.

It is especially important that all elements of the "factory to transport to construction project" construction assembly line be converted to the contract, that is, the line will become a start-to-finish element but the work is organized by the flow-line method, by unit, under a single schedule and job order. Such an organization of work aims all construction participants at the final result--the most rapid introduction of the facilities into operation.

However, many construction organizations of the ministries and agencies are still insufficiently occupied with introduction of the brigade contract, and they have not provided for fulfillment of the corresponding goals that were set for 1981. One cannot help but note that in many cases the contract brigade's work effectiveness still is not great because the provisioning of complete sets of equipment and organization and mechanization of the work are unsatisfactory.

The brigade contract is being used poorly in rural production-type construction, where it can be most effective.

In industrial construction the activity of cost-accounting brigades of prime contracting and subcontracting organizations is not sufficiently concentrated at solving the main task--the integrated construction of facilities and the timely introduction of capacity into operation.

The brigade-contract method is used very poorly in reconstructing existing enterprises and reequipping them with machinery. And this, as is well known, is one of the main directions in capital construction during the 11th Five-Year Plan.

As the work experience of N. A. Zlobin's brigade and many other construction collectives indicates, consolidated brigades achieve the best result. There is a shift in this direction: during the 10th Five-Year Plan average brigade manning rose from 10 to 19 people. Work in this area should continue. Consolidating brigades will enable the attention of engineers and technicians to be focused on the organization of the start-to-finish flow-line brigade contract, which is more complicated to provide work for than individual cost-accounting brigades. The performance of work by the forces of consolidated brigades promotes a concentration of material resources on the facilities that are most important and on those that are due for early startup.

An important component of success of the brigade contract is the creation, based not on eyeballing but on a scientific computation of the manning and skill levels of the personnel, of consolidated brigades, which are capable of doing work at various facilities, technological complexes, and large industrial clusters.

In solving the question of consolidating brigades, of course, the specifics of construction and the environment thereof should be considered in each concrete case.

An analysis of the work results of 1,475 cost-accountable brigades that was conducted in 1979-1980 by VNIPI [All-Union Scientific-Research and Design Institute] for Labor and Construction of USSR Gosstroy, in which standards-research organizations of ministries and agencies took part, showed that one-fifth of the brigades working under contract do not achieve positive results.

It was established that in only 6 percent out of 100 cases is the brigade itself guilty for this--in 36 cases the administration is at fault, in 16 cases brigades were redeployed to other facilities, and in 28 cases interdependent units that did not do their work on time were at fault.

However, it was established that in most cases these violations could have been avoided by observing plan, technological and work discipline and by organizing construction performance well.

Builders make comments and suggestions at various technical conferences and in the press about improving the mechanism of and further developing the brigade contract.

The existing regulations and the standard-practice instructions on questions of introducing the brigade contract are being reexamined. In particular, the terms for awarding bonuses to workers of cost-accountable brigades will be reviewed, taking their actual contribution to overall results into account.

During the 11th Five-Year Plan the brigade contract should become one of the basic factors in improving capital-construction affairs, in accelerating the introduction of capacity and facilities into operation, and in raising the organizational and technical level of construction.

Along with the contract brigades, greater attention should be paid to strengthening all other brigades engaged in construction.

The 26th Party Congress's instructions on further disseminating and raising the effectiveness of the brigade form of organization and of pay apply directly to construction and installing brigades.

Measures for improving the economic mechanism have been called for, planning should now be started at the brigade, and it must be oriented to the system of material incentives. The experience of advanced enterprises indicates that support for the laboring collective and its involvement in management will help no little in strengthening the authority of the supervisors of lower-level elements and in developing correct production and educational measures.

The collectives (councils) of production brigades have been granted the right, within the limits of the standards and funds established for them, to determine the amounts of bonuses and earnings that are paid out as a result of the work of the brigade's whole collective, taking into account the actual contribution of each brigade member to the overall work results, and to represent brigade members in establishing allowances and supplementary payments for vocational skill and for combining trades. It can be recommended that the administration and trade-unions organization change the skill category of a worker in the established procedure, taking into account the quality of his work. The council determines the winners of socialist competition within brigades and the amounts of their incentive awards and nominates, from among brigade members, candidates for pecuniary and moral awards for the results of socialist competition.

The brigade leader is assigned a major role.

The fruitfulness of the activity of the supervisors, quoting V. I. Lenin's words, is provided not by the force of the powers granted but by the force of prestige and force of energy and great experience, great versatility and great talent.

Comrade N. A. Zlobin stated this well in an article published in the journal STROITEL', No 1, 1981: "The brigade leader has enormous independence," he said. "For supervision of the brigade today, qualification in just one skill and an ability to help the worker and to teach him how to carry out some operation productively are not enough. Today, only he who possesses technical and economic knowledge has the right to be put in charge of a consolidated brigade. The brigade leader is also an educator."

The question has been set correctly in accordance with its essence. It is within the power of each construction and installing trust to educate such brigade leaders. For they have at their disposal the resources and opportunities for this--well-equipped training combines, teacher personnel, and, of course, a major potential for executing ideological and political-education work. What is more, many brigade leaders should also do more work on themselves and study advanced experience more deeply. And Comrade N. A. Zlobin gives an example of this. "I already had 20 years of work at construction projects behind me," says the distinguished brigade



leader "when I entered a tekhnikum. And it was difficult, and there was not enough time, but I defended a diploma after obtaining the required body of knowledge."

The well-known CPSU Central Committee decree, "On Further Improvement of Ideological and Political-Education Work," set the main tasks for construction organizations in this field. The work experience of the best construction and installing trusts indicates that a unity of ideological, moral-educational and production work leads to great positive results in all areas of activity. For example, Trust No 43 of Glavnovosibirskstroy [Main Administration for Construction in Novosibirskaya Oblast], where the party committee, the economic leadership and the construction-site committee, which relied heavily upon party and nonparty activists in conducting purposeful ideological and political education work, achieved substantial successes in production work. During the preceding five-year plan all the facilities due for startup were turned over for operation and all the other production goals were met. Not only the economic but also the social and moral values of honest, conscientious work are especially visible in this advanced collective. People who work conscientiously and with full effort for the welfare of our motherland provided for the success of the matter. In this trust, as in many other advanced organizations, youth are being educated well, and mentorship has been developed as the main method for educating youth.

"The mentors," Comrade L. I. Brezhnev noted, "are like those who transfer the relay baton of labor from the present to the future." They, of their own free will and by inclination, teach youth to love work and, sparing neither effort nor time, they transfer their rich experience and knowledge to them. Without material rewards, or, using the Leninist words, "without any kind of payment," they actively undertake this most noble business and solve one of the most important and complicated of all tasks--that of shaping full-fledged independent workers for the future. They mold, cast and grind the character of the youthful warriors of the great army of labor.

It is the task of construction collective supervisors, as Leonid Il'ich himself recommends, to assign the work of the mentors, who are the chief force in the education of young construction workers. They should also make a great contribution to strengthening labor discipline at construction projects. Economic and party supervisors of construction projects, as well as trade-union organizations, must lead collectives of construction projects and brigades more decisively in the struggle against labor-discipline violators and manifestations of wastefulness, extravagance and irresponsibility and in overcoming such ugly phenomena as drunkenness, theft and greediness. The social opinion of brigades, brigade leaders and comrades' courts must be used more skillfully to strengthen labor and production discipline. The improvement of moral and material incentives should also serve this same purpose. The observance of work discipline, as is the case with planning and production discipline, is an enormous reserve for raising capital-construction effectiveness.

The CPSU Central Committee, the USSR Council of Ministers, the AUCCTU and the Komсомol Central Committee emphasized in their decree, "On All-Union Socialist Competition for Successful Fulfillment and Overfulfillment of Goals for the 11th Five-Year Plan," that the motto of the competition should be, "Work effectively and with good quality!" The initiatives, "The workers' relay race," "Not one lagging detachment," "The five-year task is the smallest component," and others have found

wide dissemination in construction. Advanced collectives that are competing in honor of the 64th anniversary of October completed their annual production tasks by that date. For the coming year it is necessary to raise the level of the whole organization of socialist competition and to develop it in close connection with practical production tasks. Comrade L. I. Brezhnev said at the 26th Congress: "Socialist competition is the creativity of the masses. By its very essence it is founded on the high awareness and initiative of people. It is this initiative that will help to uncover production reserves and bring them into operation and to raise the effectiveness and quality of work."

Work to strengthen cadres must be intensified. Lithuania's construction organizations have achieved definite results in this field. Purposeful work is being done here to reduce personnel turnover. Important factors that affected strengthening of cadres in these organizations were an improvement of the organization of production and of work and, based thereon, a rise in the workers' earnings. Much is being done here to solve social and domestic-amenity problems and to provide workers with housing and brigades with good locker rooms. Hot food, thermos bottles and so on are being delivered to all the large construction jobs. The Lithuanian builders' experience should be widely disseminated.

The decree of the CPSU Central Committee and the USSR Council of Ministers, "On Intensifying the Work to Save and to Make Rational Use of Raw Materials and Fuel and Power and Other Material Resources," which was adopted recently, contemplated a major program of work to save and to make rational use of the country's material resources. Each Soviet person, it states, should be actively included in the struggle for savings and thriftiness at the production facility and at home and should make his own concrete contribution to this nationwide affair. Thousands of construction organizations and construction industry enterprises and tens of thousands of production brigades participated during the last five-year plan in the All-Union public inspection on the effectiveness of use of raw and other materials and fuel and power resources, which was organized by USSR Gosstroy, the Central Committee of the Trade Union of Workers of Construction and the Building-Materials Industry, and the NTO [Scientific and Technical Society] of the Construction Industry. During the inspection the collectives of construction organizations and enterprises introduced 1,532,000 rationalizers' suggestions, the economic benefit from introducing them being 3.3 billion rubles. The branch saved 1.8 million tons of metal, 7.0 million m<sup>3</sup> of timber, 2.3 billion kw-hr of electricity and 1.8 million tons of fuel.

It would seem that the effect achieved has been sound. However, the reserves and unused potential remain incomparably greater. They are concealed in no small degree at construction sites and in construction brigades. A large share of savings should be obtained as a result of local reexamination of the working designs of buildings and structures, the use of structure that is lighter in weight and more effective and of local materials, the use of new technological solutions, a reduction of losses during transport, and so on, and, directly at the construction sites, the direct waste of building materials, concrete, mortar, lumber, cement, metal and other materials should be stopped. One cannot help but note that more than half of the construction brigades working at construction projects still have not been included in the inspection for savings and are poor at saving materials, or else simply overexpend them. Thus, each working collective should respond with deeds to the party's call to save materials and energy resources. Thousands of advanced brigades are giving an example of this attitude toward the business.



I. L. Sinkevich's bricklayers' brigade (of the Pikalevo Construction Trust of Glavzapstroy [Main Administration for Construction in the Western Economic Region]) of USSR Minstroy, with 17 personnel, committed itself to save 230,000 bricks and 25 m<sup>3</sup> of mortar during the 11th Five-Year Plan. An impressive figure for one brigade. They can provoke the doubts of skeptics--230,000 bricks! However, this indicator, which is 1 percent of the bricks consumed on the job, and 1.5 liters of mortar per day per bricklayer, were already covered by the collective during the first year of the five-year plan, and in January 1982 the brigade will report overfulfillment of the commitments. In all, a 1-percent saving, and in one year this would be 400 million bricks throughout the whole country!

There should be not one brigade in construction that is not included in the inspection to save material resources.

Almost 15,000 construction-and-installing, design, and scientific-research organizations, about 5,000 construction-industry enterprises, and tens of thousands of construction-and-installing brigades are right now taking part in the All-Union inspection contest for better quality of construction.

DSK No 3 of Glavmosstroy, Pavlodarpromstroy [Pavlodar Industrial Construction Trust], Borispol'sel'stroy [Borispol' Rural Construction Trust], Mosstroy [Moscow Construction Trust] No 16 and many other trusts have achieved considerable successes in raising the quality of construction. About 150 construction organizations have been awarded diplomas by USSR Gosstroy, the trade-union central committee and the NTO of the Construction Branch for better quality of construction.

At the same time, as a whole, something is left to be desired in the quality of construction. In this great, truly state-level matter, both supervisors and brigades should have their decisive say. The first should introduce a system for controlling quality and should use it fully for solving problems. But no little responsibility also lies on the worker collectives. Many of them possess their own "keys" to raising quality. Take just the bricklayers' brigade of P. Mkrtumyan and the plasterers' brigade of S. Sarukhanyan from Trust No 3 of Minsel'stroy of the Armenian SSR--winners of the All-Union Inspection Contest for Better Construction Quality. P. Mkrtumyan's brigade turns completed work over to the plasterers of S. Sarukhanyan's brigade, and the latter turns the work over to the painters' brigade. Such worker monitoring raises a feeling of responsibility on the part of each performer, and, as a whole, the work they turn over gets only "good" or "excellent" ratings. Many workers of collectives have other "keys" for raising construction quality. They have been related in detail in STROITEL'NAYA GAZETA and the journal STROITEL', and this experience of advanced workers should be used widely in working collectives.

\* \* \*

Construction collectives are standing on the threshold of the second year of the 11th Five-Year Plan. Their task--guided by the decisions of the 26th CPSU Congress and the November 1981 CPSU Central Committee Plenum--is to work out effective measures for performing the main task--the timely introduction into operation of jobs, the further conversion of construction to the path of intensive development, and a substantial rise in the effectiveness and quality of work.

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## CONSTRUCTION

### GOSSTROY OFFICIAL REVIEWS CHANGES UNDER WAY IN CONSTRUCTION MANAGEMENT

Moscow EKONOMICHESKAYA GAZETA in Russian No 6, Feb 82 p 2

[Interview with USSR Gosstroy First Deputy Chairman Aleksey Dmitriyevich Deminov: "Construction Must Use Intensive Methods"]

[Text] USSR Gosstroy First Deputy Chairman A. D. Deminov answers EKONOMICHESKAYA GAZETA's questions.

[Question] Aleksey Dmitriyevich, the editorial mail box gets many letters with the request that the features of the construction program for the 11th Five-Year Plan be described.

[Answer] Enormous capital investment--700 billion rubles from all financing sources--has been earmarked for developing the national economy during the 11th Five-Year Plan. During the 10th Five-Year Plan the amount was 634.1 billion. Growth in comparison with other five-year plans is not great in terms of percentages, but in absolute terms it is almost 1½-fold the amount of capital investment of the Fourth Five-Year Plan.

Such a scale of construction makes many demands, and it is necessary primarily to pay the main attention to raising effectiveness and to speeding up the yield from the resources aimed at developing the national economy. All this signifies a decisive turn in the direction primarily of conducting construction intensively. Much more meaningful final results are to be achieved with comparatively fewer expenditures.

Intensive methods of management compel a more exacting attitude toward reserves for labor productivity growth in construction. Primarily we are counting on technical progress. The amounts of progressive types of construction work--prefabricated and large-panel construction--will be increased 1.2-fold. The production of effective materials and structure with increased preparation at the factory will be increased severalfold. The unit capacity of construction mechanisms will grow. The supplying of highly productive hand and mechanized tools for the more labor-intensive operations is to be expanded 2-fold to 3-fold.

The economic benefit from introducing new equipment during the 11th Five-Year Plan is expected to be double that of the 10th Five-Year Plan. Already in 1981 it has been possible to save the labor of more than 70,000 construction workers through this factor.

However, questions of the practical use of the achievements of science and technology remain, as before, a bottleneck. USSR Mintyazhstroy [Ministry of Construction of Heavy-Industry Enterprises], USSR Minpromstroy [Ministry of Industrial Construction] and USSR Minstroy [Ministry of Construction] lag greatly in fulfilling tasks for the introduction of new equipment. Other economic supervisors lack initiative and persistence in this important matter. Meanwhile, the time has come to reexamine radically the approach to solving many questions about the practical use of innovations. The plan for mastering and introducing new equipment must be linked organically with the indicators of the basic activity of construction and installing organizations and of their industrial base. The use of new equipment should be mandatory.

[Question] And how is the capital investment structure being improved?

[Answer] Appropriations for the reconstruction of enterprises and for reequipping them with machinery will grow 21.2 percent during the five-year plan, and their share in expenditures for production-type construction will be 32.5 percent, versus 29.2 percent during the 10th Five-Year Plan. The share of equipment will be increased from 36 to 39 percent, and the share of construction and installing work in the total amount of capital investment will be decreased, correspondingly, from 54 to 51 percent. It is difficult to overestimate the importance of these factors.

The creation and assimilation of new capacity based upon the reconstruction of existing enterprises and the reequipping thereof with machinery are proceeding 1.5-fold to 2-fold more rapidly than for new construction, the expenses will be repaid in one-third the time, and yield on capital turns out to be 1.5-fold higher. An increase in the share of expenditures for equipment by just 1 percent means growth in the annual amount of industrial production by 500-600 million rubles. Consequently, during the 11th Five-Year Plan this promises more than 1½ billion rubles' worth of additional products.

[Question] The 26th Congress and the November 1981 CPSU Central Committee Plenum set the task of reducing the amount of uncompleted construction during the five-year plan to the level of the standards. What is being done in this area?

[Answer] In recent years it has been possible not only to stop the growth but also to reduce somewhat the level of uncompleted construction. In proportion to the annual amounts of capital investment, uncompleted construction was 91 percent in 1980 and 89 percent in 1981, and right now it is 84 percent. The standard backlog of construction-work starts has been set at 67 percent.

As we see, a very large amount of work remains to be done to carry out the established task. Actual construction time at many production facilities greatly exceeds the standard periods. Dispersion of resources and lack of balance in plans are telling here. I will note that each ruble invested in construction and not converted into active status during the year causes a loss of 15 kopecks. At our work scale, this is equivalent to annual losses of several billion rubles. For these same resources can and should yield a profit.

During the preparation of plans, their mutual coordination and their fulfillment, the requirements of "Norms for the Duration of Construction and the Backlog of Construction-Work Starts for the Construction of Enterprises, Buildings and Structures" (SN 440-79), which were approved by USSR Gosstroy and USSR Gosplan for all



branches of the national economy, should be observed without fail. Any actions aimed at bypassing this document will inevitably lead to the paralysis of large amounts of state funds. Matters, as was noted above, are already being adjusted. But the deficiencies are being eradicated slowly.

For example, in 1981 the capital construction plan included 334,000 facilities for production purposes. The average annual number of workers engaged in construction and installing operations and in subsidiary production work per construction project was estimated at 109, or 11 per facility. Those economic workers and supervisors of local organs, which, "in the interests of the matter," are striving at all costs to begin new construction, should think about these figures.

As was noted at the November 1981 CPSU Central Committee Plenum, during the compilation of the 11th Five-Year Plan the existing material and labor resources, the capacity of construction organizations, and the substantial amounts of uncompleted construction were considered realistically. "In essence, right now there is a realistic, better-balanced plan for capital construction. This will establish the necessary conditions for normal operation," said Leonid Il'ich Brezhnev in his speech at the plenum.

The concentration of forces and resources at first-priority projects and at early-startup construction projects of the national economy and the allocation of all that is necessary for their rapid introduction into operation and for the assimilation of design capacity are to be greatly intensified. Suffice it to say that during this five-year plan the volume of introduction of fixed capital into operation through state capital investment (627 billion rubles) will, for the first time in our country, be greater than the total of the funds from this same source (618 billion rubles).

Strict restrictions have been established for the construction of administrative, spectator, and sports buildings and structures, and also of facilities that are being erected above the ceilings for state capital investment from noncentralized sources.

[Question] Our readers call attention to the slow introduction into practice of the new methods of management. How is this, which slows the work to realize well-known party and government decisions about improving the economic mechanism, explained?

[Answer] The builders have not succeeded in integrating the implementation of all the measures called for by the 12 July 1979 decree of the CPSU Central Committee and USSR Council of Ministers. The preparation of a number of documents has been stretched out, which has led to a discrepancy in the deadlines for introducing certain innovations into operation. These questions have repeatedly been analyzed critically at sessions of USSR Gosstroy's board and its party committee.

Nor is the quality of the various documents that have been issued of high quality. Letters of workers, primarily construction-project economists, which contain specific recommendations, are of great help in improving them. All of them are examined with the most careful attention.

And there is another side to the coin. I have already spoken above about a certain psychological barrier and the force of inertia. These, unfortunately, also relate fully to the introduction of the new management methods.

Right now all the basic documents are ready and approved and mutually coordinated with each other. One task--the most rapid and economical achievement of the final results and the introduction of facilities--has been set for all construction process participants. Under these circumstances it is necessary to show initiative, to take up a principled position (I am speaking about economic supervisors of all ranks and about economists), in order to achieve a radical break and to provide for a sharp rise in construction effectiveness, as the party requires.

Unfortunately, this is not being done everywhere, nor by everyone. From the first, the trust's manager bows to pressure and accepts into the plan facilities that have not been provided completely and on time with documentation, financing and resources, and then complaints break out about "objective causes," a lack of balance in tasks, and a lack of perfection of the economic mechanism. Such cases, alas, still are not rare. Many violations of plan discipline arise in precisely this way. In order to prevent them, not only economic penalties and levers are needed, but primarily a rise in the party and civic responsibility of the workers. The role here for party organizations at the construction project, which have been granted the right to monitor the activity of the administration, is great.

For two decades I have been following attentively the work of Glavzapstroy [Main Administration for Construction in the Western Economic Region] and its chief, Hero of Socialist Labor K. A. Glukhovskiy. From five-year plan to five-year plan, this main administration's builders have been steadily carrying out plan tasks for introducing facilities in Leningrad and in its oblast. Comrade L. I. Brezhnev gave a high appraisal of its work at the November 1981 CPSU Central Committee Plenum.

What made the success possible? One of the features characteristic of Glavzapstroy is a strengthening of the economic services, to which enormous significance in solving basic problems is attributed. Figuratively speaking, the economists here are navigators, who lay down the course and follow up on precision in adhering to it. It is not accidental that the new management methods are being introduced actively and effectively in the main administration's organs

But, where economic work is held down and the economists trudge along in the rear-guard, they travel slowly on the road of innovation.

The rhythm of our construction projects leaves something to be desired. The main part of the facilities is planned for introduction in the second half of the year, mainly in the fourth quarter. The turnover of construction commodity output in the Ukraine's Mintyazhstroy was distributed as follows in 1981: in the first quarter 8 percent, the second quarter 18 percent, and the third and fourth quarters 74 percent. Mintransstroy [Ministry of Transport Construction] planned 4 percent of construction commodity output for the first quarter of the year, 68.2 percent for the fourth, and USSR Mintyazhstroy planned, respectively, 5 and 61 percent.

The conversion of construction projects to the integrated supplying of materials through USSR Gosstnab regional organs in accordance with the orders of contracting organizations and with requirements as determined by the designs and budget estimates has been prolonged. Meanwhile, USSR Gosstroy has put into effect GOST 21-109-80, "A System for Design Documentation for Construction. Lists of Requirements for Materials," and issued "Standard-Practice Procedures for Determining Requirements for Materials, Structure and Parts Within Design Documents." The matter is up to USSR Gosstnab. For up to this day, the share of organizations that are



using the progressive system of supply does not exceed 9 percent of the overall annual construction program.

There are major deficiencies in the financing of and the granting of credits for construction. Not by far do all USSR Gosbank and USSR Stroybank institutions provide for the continuous granting of credits. There are many cases of wrongful stoppages in the granting of credits for expenditures for uncompleted work.

All these negative phenomena hamper the full and effective implementation of the new management methods.

[Question] In the system of measures for improving the economic mechanism, USSR Gosstroy in particular was given the task of implementing the conversion to planning and accounting for labor productivity and the wage fund in construction in accordance with net output (standard) or another indicator that reflects more precisely the changes in expenditures for labor. What stage is this work in?

[Answer] A number of new indicators for planning and accounting for labor productivity have been examined by USSR Gosstroy and other agencies. In order to convert contracting organizations to planning and accounting for labor productivity in accordance with net output, instructions have been issued to single it out in budget estimates, consolidated budget-estimating standards, and price lists for construction. The development and coordination of Temporary Standard-Practice Instructions for the Application of Standard Equivalent Net Output (NUChP) to Construction have been completed. This document should now be approved by USSR Gosplan.

I will note that Lithuanian Minstroy organizations were converted to the new procedure for planning and accounting for labor productivity and the wage fund in accordance with the NUChP indicator by way of experiment in 1980, and, beginning in 1981, Lithuanian Minsel'stroy [Ministry of Rural Construction] and Latvian Minstroy organizations were so converted. Their experience is being generalized and analyzed. In order to extend assistance in introducing NUChP, local-group seminar conferences were held last year in Riga, Tashkent, Kalinin, Tbilisi, Khabarovsk and Chelyabinsk.

Construction organizations are increasingly being converted to planning and accounting for labor productivity in accordance with NUChP. However, not all clients are carrying out the instructions about singling out standard-equivalent net output in budget-estimating documentation. For example, USSR Minchermet and Minudobreniy [Ministry of Fertilizer] singled out NUChP in only one-fifth of the documentation of the overall 1982 program for USSR Mintyazhstroy organizations that have converted to the new procedure, and USSR Mintsvetmet [Ministry of Nonferrous Metallurgy] singled it out in only 40 percent of the papers. Obviously, this influences progress in introducing NUChP negatively.

As for the large-scale conversion in construction to planning labor productivity under the new indicator, this is contemplated after introduction of the new budget-estimating norms and prices, with NUChP singled out therein. This work is to be completed before the end of the five-year plan. The search for a more perfect indicator continues.

## CONSTRUCTION

### TURKMEN INSTITUTE DEVELOPS SEISMIC-RESISTANT BUILDING MATERIALS

Ashkhabad TURKMENSKAYA ISKRA in Russian 10 Mar 82 p 2

[Article by K. Durd'yev, deputy manager of the Introduction Section of NIISS [Scientific-Research Institute for Seismic-Resistant Construction] of TuSSR [Turkmen SSR] Gosstroy: "From Development to Introduction"]

[Text] The collective of the Scientific-Research Institute of Seismic-Resistant Construction of TuSSR Gosstroy sees its task to be one not only of enriching science's potential but also one of introducing useful innovations into production. No little work has been done in this area. With the scientists' help, an industrial base for porous aggregate has been established in the republic. Five enterprises have been built whose total capacity for producing high-quality keramzit is 600,000 m<sup>3</sup> per year, and the manufacture of articles from lightweight concrete has been arranged.

The technology for the heat-insulation of pipes, using a lightweight protective material--furfuryl foam plastic, based upon furfuryl resin and Karakum sand--has been developed for the conduit-free laying of heating lines. This method is extremely economical.

In recent years progressive bituminous-emulsion mastic compounds have begun to be used in this country and abroad to lay roofs for buildings. The Laboratory for Asphalt Materials of our institute has proposed and tested new compositions of mastic that are high in strength and correspond more fully to the natural and climatic environment of the TuSSR.

Bituminous-emulsion mastic can be used successfully in the waterproofing and anti-corrosion protection of underground portions of buildings and structures and of reinforced-concrete and metal members, and also in the impregnation of gravel preparations for the footings of structures, with a view to strengthening them. Experience in the use of mastic in waterproofing Karakum Canal structures confirmed their resistance to a strongly aggressive sulfate medium.

Such a scientific development of the institute as a technology for manufacturing autoclaved cellular concretes based on Karakum sands for making effective wall, finishing, sound-proof and heat-resistant materials also is being used. A distinguishing feature of walls made of cellular concrete blocks, compared with walls made of silicate brick, is the three-fold reduction in heat conductivity and a reduction in the consumption of mortar and expenditures for live labor.

In brief, the institute's developments are yielding advantages. The ministries of trade, building-materials and construction of the TuSSR are showing definite activity in introducing them. We are establishing regular ties with enterprises and organizations, and we are sending brigades of specialists to them to extend scientific and technical assistance. This will permit the time needed for introducing them to be reduced and the responsibility of workers, scientists and specialists for their introduction to be raised.

Nevertheless, the materialization of scientific achievements remains complicated. Various organizations, although they undertake to master new things but in small amounts beyond the plan, stretch out their introduction by years, at times considering the innovations to be secondary categories of operation. Thus, upon instruction of the TuSSR Ministry of Construction, Marystroy [Mari Construction Trust] concluded back in 1978 an agreement with the institute to use crack-resistant mastic for installing roof coverings. However, since the mastic had never been mastered, the ministry in May 1981 canceled this agreement. "A lack of facilities and the necessary materials" supposedly served as the motivation. Neither is this ministry carrying out the TuSSR Gosstroy decree about disseminating everywhere the use of bituminous mastic for installing roofs and for waterproofing the underground parts of structures, and it is prolonging organization of the centralized preparation of mastic for wide use at Ashkhabad city construction projects.

The laying of conduit-free heating lines, cellular concrete made with Karakum sands and prefabricated reinforced concrete with compound additives, which could save hundreds of thousands of rubles of state funds, are being used in small amounts and, therefore, with insignificant benefit.

In this connection, the experience of the Leningrad Experimental Machinery Plant of Lenoblremstroy [Leningrad Oblast Construction-Machinery Repair Administration] should be recalled. On our recommendation it successfully mastered the production of monolithic heat-insulating foam-plastic pipe for the conduit-free laying of pipelines, and in 2 years it sold 46.8 kilometers of such pipe to Leningrad construction organizations. Savings were 849,000 rubles, or 2,500 tons of cement, 535 tons of metal and 26,000 mandays.

The republic's Ministry of Municipal Services planned to create in 1982 a department to make pipe that is heat-insulating and waterproof for the conduit-free laying of heating grids in Ashkhabad city. It would have a capacity of 15 kilometers of heating line per year. But the solution still remains on paper.

In our view, the cause of this situation is well-known inertia. Sad as it may be, many economic workers are not always interested in the introduction of that which is new: for it does not bring quick advantage. On the contrary, it frequently comes into confrontation with the existing indicators and established technologies and compels change in the whole production system. Innovations require of man new knowledge, habits, and--this is everything--additional effort. In brief, the most difficult thing is to overcome psychological barriers.

Imperfections in planning also interfere. Measures for scientific and technical progress do not always foresee the influence of this factor on raising the final effectiveness of production. It would seem that plans must be based upon a level of indicators that can be supported only by the introduction of scientific and technical achievements. This will compel supervisors of enterprises and

organizations not to resist innovations but to search them out, for there will be no other method for carrying out the task.

The final results of scientific achievements must be incorporated in designs and estimates. Here TuSSR Gosstroy should have its say. In order to develop technical progress actively, it is useful to establish special creative brigades at enterprises and construction projects. This needed work should be widely encouraged--morally and materially.

It is desirable, in my view, to organize under the republic's Gosstroy a council for the coordination and guidance of the work of introducing the achievements of science and technology into construction. The council must include specialists of the concerned organizations, which have been granted rights, full authority and responsibilities. TuSSR Gosstroy publication of an informational bulletin on construction, even once per quarter, comprising 4-5 press sheets, and on the order of about 500 copies, would help matters.

In many of the country's republics, in order to speed up scientific and technical progress, representatives of science and production meet frequently, with a view to evaluating the quality of scientific output and to exchange experience in introducing it. Thus the paths for solving the most important tasks decreed by the 26th CPSU Congress--to master the achievements of the scientists better and more rapidly--were discussed a couple of days ago at a meeting of activists of scientific institutions and enterprises of the Ukraine's capital, and the coordinating center for strengthening the ties of science with production in Kiev is the Council for the Promotion of Scientific and Technical Progress under the party's city committee. The republic regularly conducts inspections on introduction of the achievements of science and technology into the national economy. It would be useful to transmit this experience to us.

In conclusion, I would like to recall that 90 percent of the growth of national output during the current five-year plan is to be obtained through labor productivity growth. And that means that the national economy should obtain new equipment and technology. But materialization of the achievements of science and technology cannot be managed without precise planning, without determination of the specific deadlines for developing technical and technological innovations and for introducing them into production, or without the wide dissemination of advanced experience.

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## CONSTRUCTION

### LITHUANIA'S EXPERIENCE WITH NEW CONSTRUCTION RATING STANDARDS TOLD

Vilnius SOVETSKAYA LITVA in Russian 18 Mar 82 p 2

[Article by S. Movshovich, manager of the Lithuanian Republic's USSR Stroybank Office: "The Potential Is Not Being Used Completely"]

[Text] Certain results of the use of the standard-equivalent net-output indicator in Lithuanian SSR Minstroy [Ministry of Construction] organizations.

Comrade L. I. Brezhnev, in speaking at the November 1981 CPSU Central Committee Plenum, told about the need to bring the economic mechanism into correspondence with the requirement that "the economy should be economical." It is this also at which the CPSU Central Committee and USSR Council of Ministers decree, "On the Improvement of Planning and Strengthening of the Influence of the Economic Mechanism on Increasing Production Efficiency and Work Quality," was aimed. Some of the many other measures called for a gradual conversion of construction and installing organizations to use an indicator that would reflect labor expenditure more precisely than those indicators that have existed for many years. In realizing the well-thought out measure, the Lithuanian SSR Ministry of Construction undertook at the start of 1980 to conduct an experiment in practical application of the standard equivalent net-output indicator (NUChP).

Thus an attempt was made to depart from the notorious "gross," which heats up the striving to do the maximum possible amount of capital-intensive work. For all the benefits were directly associated with this: the sizes of the funds for both wages and material incentives. It had been possible to have good indicators and enter the ranks of the advanced and, at the same time, fail to meet the deadlines for turning facilities over for operation. It is for this reason that usually, let's say, the erection of prefabricated reinforced concrete was carried out so rapidly, for the cost of each piece of structure here was in the hundreds or even the thousands of rubles.

At the same time, when evaluating the activity of construction organizations in accordance with standard-equivalent net output, the finishing work is more profitable. And indeed it was this which, not yielding a weighty addition to the "gross," usually held back and is holding back the turnover of jobs. In 1981 the actual output per worker was: in finishing-work organizations 1,872 rubles, and in general construction organizations--from 798 to 1,446 rubles.



Much preparatory work was done before the experiment. It was necessary to work out its methodology, to recompute several tens of thousands of budget-estimating standards, and to arm workers with the appropriate knowledge. Minstroy organizations now obtain the amounts of NUChP by recomputation of the budget-estimated cost (in accordance with the standards set by the methodology approved by USSR Gosstroy). More than 30,000 norms were developed for all types of the budget-estimating cost standards that are effective within the Lithuanian SSR.

In 1981 the amounts of NUChP were computed according to consolidated indicators which define the share of the standard-equivalent net output in construction and installing work. A detailed recomputation by category and by type of operation is made in construction organizations for current planning, by section and by brigade.

Minstroy organizations achieved clearly positive results during the experiments. Primarily for the indicators associated with the introduction of facilities. While in 1979 the plan was fulfilled by 96 percent for construction commodity output, by 95 percent for facilities due for startup, and by 96 percent for the introduction of living space, in 1981 the figures were, respectively 102, 103 and 106 percent. While in 1979 it was not possible to increase labor productivity (in comparison with the preceding year), in 1981 it grew by 7.4 percent in terms of NUChP.

It should be noted that a certain increase in the share of expenditures for wages is observed in the amounts of construction and installing work. It is true, in the first place, that this is similar to growth in the 10th Five-Year Plan, and, second, it was stimulated by an increase in the fund for material incentives and the payout therefrom for overfulfillment of tasks for raising labor productivity, computed in terms of NUChP. For example, in the first half of 1981 it increased throughout the ministry by 246,000 rubles.

In citing even preliminary results of the experiment, one cannot in any case suffer in silence the extremely serious errors, omissions and failures. It would seem that unless they are eliminated or overcome, it will be difficult and, perhaps, even impossible to intensify and expand in construction the process of improving the economic mechanism.

I will not begin to speak here about the errors that were committed in figuring under NUChP. In a new business these were inevitable. They appeared fairly rapidly at the ministry itself and at Gosstroy and Stroybank institutions.

Much more alarming is the circumstance that USSR Minstroy is even now still establishing for our republic's Ministry of Construction, wage indicators that are computed in terms of SMR [construction and installing work] in budget-estimated prices, not in terms of NUChP. The indicators for standard-equivalent net output were computed by Lithuanian SSR Minstroy itself, without the later approval by higher organizations. In short, they make up the plan for themselves and they themselves approve it. The interests of the matter also require that the Union ministry establish for Lithuanian SSR Minstroy (as the settlement indicator) in the mandatory procedure the amount of NUChP and confirm the task for growth of labor productivity (computed in terms of this indicator).

Moreover, use of the NUChP indicator is not now linked with the turnover of facilities for operation. In other words, with construction commodity output. In the budget-estimating documentation, the indicators for standard-equivalent net output

have not been singled out, either for construction elements or as a whole. Therefore, an objective criterion for checking correctness of the plan in terms of NUCHP and its fulfillment is lacking. Monitoring this on the part of the client was not called for.

The experiment's potential is also restricted by the circumstance that substantial deficiencies are accompanying the work of Ministry of Construction organizations, as before. The amount of construction and installing work being carried out is less than the amount carried out under the 10th Five-Year Plan. Deadlines for introducing certain most important facilities are not being met. Plans for reducing prime construction costs and for obtaining profit are not being fulfilled. The system for supplying materials and equipment needs considerable improvement.

Monitoring is necessary so that use of NUCHP will not slow the mechanization of finishing work and not engender a stimulus to perform these operations manually. USSR Gosstroy must develop norms and costing standards for the execution of finishing operations by the mechanized method and then use these costing standards widely in making up budget estimates for construction work.

But still there is no doubt of the experiment's advantages. It should be continued, and maximum use should constantly be made of the potential that is opened up by way of improving the economic mechanism.

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## CONSTRUCTION

### DEVELOPMENT OF TASHAUZ INTO MODERN CITY HAILED

Ashkhabad TURKMENSKAYA ISKRA in Russian 25 Mar 82 p 4

[Article by Sonagul Razakova, sewing-machine operator of a consumer-goods factory and Deputy of the USSR Supreme Soviet: "In the Republic's Cities--Tashauz: a Spreading of the Stars of the Terrestrial Sphere"]

[Text] I read the CPSU Central Committee decree, "On the 60th Anniversary of the Forming of the Union of Soviet Socialist Republics" with a feeling of high civic pride. Sinking especially deeply into my spirit were these words: "We have a right to be proud of the fact that, within the overall system of workers of all the country's nationalities, the peoples of the former nationality backwaters, which formerly were doomed to everlasting backwardness, have stepped confidently into the socialist future, bypassing capitalism, and have attained high social progress."

My native city of Tashauz is a most bright confirmation of that. Although frankly, even youngsters recall that two bullock carts could scarcely drive the narrow back streets of the so-called "old city," and the housing of the old development predominated over the modern, imparting facelessness and isolation to the city.

Well, now take a look at the photograph [not reproduced]. It is only a fraction of modern Tashauz. But it also surely strikes those who visited our city only a few years ago. Yes, well-tended avenues and streets many kilometers long, with concrete arms, sprang up literally before my very eyes, and uniquely shaped apartment houses and a multitude of facilities for social and cultural purposes were raised up.

I will speak the language of figures. Last year alone the citizenry obtained 24,508 m<sup>2</sup> of housing space, a mixed-feed plant was turned over for operation, and a new school for 1,176 students was opened. Much attention is being devoted to the amenities for Tashauz. A landscaping department for the city and a housing operations trust, which were organized with the active support of city organizations, made it possible to assimilate about 2 million rubles. Almost 50 kilometers of roads were newly repaired, gas service was installed in 1,155 apartments and 8 enterprises, organizations and institutions, and many trees and much shrubbery were planted for this amount.

It is nice to note that all of the city's 22 enterprises coped successfully with the plan for the first year of the current five-year plan. This concerns realized output. But for the income, there were also expenditures. This year a new



sewn-goods factory, which will produce consumer goods worth 1 million rubles per year in all, will be introduced. A cooler that holds 1,200 tons will enter operation at the meat combine. The rebuilding of existing enterprises continues.

Just as before, much attention is being paid to the construction of housing and social and cultural facilities. In the second year of the five-year plan a new kindergarten for 320 children, a dormitory for the branch of the Turkmen Agricultural Institute, a hotel for 220 guests, a forestry school, and an education building of the medical school will go into operation. Well, and what about housing? The pace is a bit higher than last year's: the builders have committed themselves to turning over about 30,000 m<sup>2</sup> of living space, the accent being placed on the erection of improved-type buildings, together with the necessary facilities for social and cultural purposes.

Welcome! We will show with pride the city that is farthest north in the republic. A city that represents tens of nationalities of the mother country.

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## CONSTRUCTION

### GEORGIAN CAPITAL CONSTRUCTION PERFORMANCE IN 1981, 1982 REVIEWED

[Editorial Report] Tbilisi KOMUNISTI in Georgian on 14 March 1982 page 1 carries KOMUNISTI commentator Economics Candidate E. Gaprindashvili's 1,600-word review of Georgia's capital construction performance in 1981 and the first period in 1982, citing numerous figures. Despite substantial contributions to the economy, the Construction Ministry and the Rural Construction Ministry lagged badly in many plan indicators, in particular the completion of a number of major projects that were to have gone into operation last year. Performance continues to slide this year, as the various organizations and trusts are still playing catch-up for last year. In January, not one residential building was completed, nor were installation work targets met. Funds and manpower continue to be scattered among too many projects, so that the rate of uncompleted projects remains high. Project-estimate and technical documentation is too often late and full of mistakes, and estimates are stated too low and have to be revised upward during construction. Yearly plans are highly arrhythmic, with the bulk of work to be done in the final quarter. Introduction of the new criteria, in particular "commercial construction output" [tovarnaya stroitel'naya produktsiya], has been slow, likewise the crew contract method.

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## CONSTRUCTION MACHINERY

### DEVELOPMENT OF INDUSTRY DURING 11TH FIVE-YEAR PLAN

Moscow STROITEL'NYYE I DOROZHNYYE MASHINY in Russian No 1, Jan 82 (signed to press 13 Jan 82) pp 1-4

[Article by V.I. Chudin, minister of Construction, Road and Communal Machine Building of the USSR, "Tasks for construction, road and communal machine building during 11th five-year plan and basic program problems of branch development"]

[Text] The tasks which flow from the resolutions of the 26th CPSU Congress, the November (1981) Plenary Session of the CC CPSU, the positions and conclusions contained in the speech of Comrade L.I. Brezhnev, general secretary of the CC CPSU, at the Plenary Session and the sixth session of the 10th convocation of the Supreme Soviet of the USSR on the economic and social development of the national economy during 1981-1985 define the further direction of the branch of construction and road machine building.

The plans and organizations of Minstroydormash are now producing more than 2,000 machinery and equipment items, equipping road and meliorative, industrial and residential construction, the logging and peat industry, and construction materials industry, public utilities and many other branches.

Mastering the output of new equipment and increasing the overall volume of production of all types of machinery and equipment by organizing their production in sufficiently large industrial series is in pursuit of one main goal: to provide the conditions for constant, undeviating growth and labor productivity as the final and basic result of work in the consumer branches, primarily capital construction. It is to this basic requirement which all of the activity of the ministry is subordinate in defining the tasks of increasing the technical level, increasing the volumes of machinery and equipment while simultaneously satisfying the demand of the national economy for the product of the branch to the fullest possible extent.

The Ministry system includes 11 all-union industrial associations and 4 production associations which are directly subordinate to the ministry and which are comprised of 154 production associations and enterprises (in 1946 the Ministry had 54 working plants).



The amount of production in 1981 was 230 times that in 1946 (the year in which the branch was formed).

Of the total volume of production for the national economy, Ministry enterprises produce 82% of all scrapers and truck-mounted cranes, 12% of all tracked cranes, and 40% of all pneumatic-tired trains, 82% of all tower cranes, 60% of all lifts, 77% of all machinery for urban public utilities, 95% of all mechanized and 47% of all manual construction and installation tools, 80% of all drills, 46% of all mills, 32% of all fans, 96% of all air conditioners, 100% of all completely revolving excavators with bucket capacity of up to 2.5 m<sup>3</sup>, bulldozers, motor graders, snow plows, bucket loaders, 25-, 40- and 63-ton cranes built on special chassis, fire engines, cement mixers, asphalt layers, brick and pile presses, machines for cleaning public buildings, electrical and pneumatic vibrators and other products.

During the 10th five-year plan, the volume of production increased by 24%, with more than 90% of the increase due to improved labor productivity. Work on increasing the technical level of equipment produced made it possible to assimilate the production of 450 types of new types of production and to remove 430 types of obsolete machines and equipment during 1976-1980, which provided an increase in the proportion of top-quality production from 7.6% in 1975 to 27.7% in 1980.

In addition, 9% of all obsolete articles are about to be taken out of production, and 26% are to be modernized as soon as possible.

The situation in the branch is complicated by the fact that there is still a tendency toward poor utilization of basic funds (especially their active part), technological equipping of production remains at a low level, primarily due to the inferior tool base at most plants, the structure of the pool of machine tools does not correspond to the contemporary nature of production; as a result, universalism in production methods has resulted in inadmissably large consumption, since high worker qualifications are required. Taken together, all of this has had an effect on the extremely alarming situation regarding the technical level of production, its prime cost and quality unsatisfactory to consumers in terms of many scarce groups of product produced by the branch. There is an urgent requirement to accommodate all of these tasks in appropriate goal, scientific-technical and branch integrated programs for the 11th five-year plan, the accomplishment of which, supported by appropriate financial, organization-technical and moral factors, will make it possible to eliminate the existing shortcomings and to execute the tasks facing the Ministry.

For this reason, in developing the production program for the 11th five-year plan, a production program has been prepared and introduced which differs significantly in structure from those plans of preceding five-year plans.

Specifically, together with increasing the volume of production by 30% in 1985 over the 1980 level, the five-year plan also has provisions for an increase in deliveries of the scarcest and most efficient machines and equipment, including machinery with increased unit capacity. However, the resolution of this program is closely associated with the technical level of the output product, in connection with which a corresponding program for improving the technical level has been developed.

This program is a substantiated plan of measures based on precise calculations aimed toward improving the technical level of branch production with evaluation according to the final results (productivity, resource, reduction in specific material and power consumption indicators, etc.).

As a result of implementing the program, an increase in a factor of nearly 1.5 is foreseen in the development and series production of new types of machinery over the level in the 10th five-year plan.

The creation of new economical high-output construction, road and utility machinery is impossible without universal utilization of hydraulic drives, the extensive application of which is delayed by a number of factors, one being the sharp disproportion between the demand and the capabilities of producing it.

In order to eliminate this disproportion, the Ministry has created the specialized all-union "Soyuzstroygidromash" association for the production of hydraulic drive components. This has made it possible to concentrate, within a single production subdivision, the production of modern hydraulic equipment, and as a result to fulfill the branch program for increasing the technical level of construction, road, utility, firefighting and other equipment produced.

The program for increasing the technical level has provisions to raise the production of products bearing the Seal of Quality to 40% during the 11th five-year plan. This must be expressed not only in increased resource, viability and reliability equipment, and not only in increased operator productivity, but also as a necessary condition for conserving all types of materials, energy and labor.

The introduction of new construction and road-building equipment responding to modern technical specifications depends to a definite extent upon related branches of industry which supply the basic machines and component articles for the branch production; maximum attention on the part of developer organizations and manufacturing plants must be devoted to working by agreement with these other branches.

The most acceptable direction in accommodating the tasks put forth by the production program and the program for improving technical level is the concentration of groups of like machinery and equipment on the basis of maximum standardization both in terms of construction (so-called modular principle), and in terms of parallel specialization in the structure of the technological equipment of plants oriented toward producing specific machines and equipment. This principle makes it possible to optimize the pool of machine tools of a limited number of plants without wasting money, and to improve the utilization of basic funds at the same time. These tasks are included in the technical re-tooling program of the branch for the 11th five-year plan.

The successful implementation of the branch production program and the program for improving the technical level of product is possible only with simultaneous intensive implementation of the program for technical re-equipping and reconstruction during the 11th five-year plan with a sharp change in the direction of capital expenditures from all sources on optimizing production technology, improving the makeup of the pool of machine tools and intensifying the utilization of active funds.

This program has provisions for the following:

- increasing the number of mechanized assembly lines, automatic and semiautomatic lines;
- improving the structure of the pool of metalworking equipment by increasing the number of automatic devices, semiautomatic devices, special machines, aggregate machines and machines with numerical program control;
- approximately doubling the annual amount of production of special tools and technological accessories in order to improve the level of technical equipment of production and its corresponding nature of production (series);
- expanding by 20% the sphere of application of progressive welding processes;
- introduce 15 part-rolling machines in 1981;
- switch over to low-waste technology for producing mass-use parts.

A great deal of attention is being devoted to technological processes which are new in principle and which are replacing traditional ones, including powder metallurgy, which makes it possible to reduce the labor intensity of produced parts and to improve their wear- and heat-resistance, which should replace traditional casting methods and some types of electroplating.

Implementing the program for technical re-equipping of branch enterprises will save the labor of more than 40,000 workers, which will be significant in improving basic production funds, their active part, in increasing the rates of growth of labor productivity in the branch and at consumer entities; it will also create a systems approach at branch enterprises toward quality assurance due to rigid technology frameworks; as a final result, all of this will provide the national economy of the country with reliable machines, mechanisms and equipment.

The branch leadership, based on the directives of Party and government resolutions for thorough conservation, considered it necessary to develop a special branch program for rational utilization of the created production potential, all types of material, labor and financial resources (the "Ekonomiya" program), i.e., a group of tasks directed toward conservative, skillful and effective utilization of all resources in the branch - labor, basic funds, fuel, raw materials - in order to increase the amount of production with primary orientation toward the resources of the savings achieved.

The leading collectives of the branch have accumulated substantial positive experience in conserving raw materials, fuel and energy and improving production quality at the same time. An initiator of the struggle for savings in the branch is the Valinin excavator plant, where the collective has undertaken a socialist competition under the banner "Let economics be economical".

Nonetheless, most plants have not made the required breakthrough in improving the utilization of material resources, in connection with which the "Ekonomiya" program has included steps to ensure a 20% reduction in the norm for rolling ferrous metals, as well as provisions for conserving fuel, power and labor resources, improving materials storage, introducing the required order in utilizing turnaround funds, including an objective level of normatives and a number of others.



Implementation of the planned branch integrated programs is unrealistic without clearly coordinated activity and specialization of the developer organizations of new technology and techniques and without thorough improvement in management systems. Regardless of the fact that the branch provides measures for improving management, specifically, there has been a certain restructuring to a two-three branch system, no significant yield has been achieved: in this connection, development is being completed of a branch program for "Management improvement". It has been recognized advisable to create on the basis of two associations the large "Soyuzstrommash" association and the independent "Volgotsemmash" production association, which will make practical resolution possible of problems in designing and producing all types of equipment for the construction materials industry within these subdivisions. Other measures to improve management were also accomplished in 1981, albeit not completely.

The main purpose in improving the structure of the branch is essentially to fulfill the directives of the Party and government to switch over to a two-branch structure of industrial management, to create large associations for the production of analog types of machinery and equipment with their own design-technological subdivisions, concentration of production of unified units and assemblies and machines built using the modular principle, i.e., concentrating all forces and facilities in specialized subdivisions directly subordinate to the Ministry.

In resolving the economic tasks imposed by the 26th Party Congress, we must turn our attention to the social development of labor collectives. We are obliged to ensure working and living conditions at branch plants and in organizations which fully respond to the level of growing demands and further supporting of personnel in production. This is the goal of the authorized integrated plan for improving conditions, preserving labor and sanitary-health measures for the 11th five-year plan. Its accomplishment will make it possible to construct new, and reconstruct existing, sanitary accommodations with a total area of 34,000 m<sup>2</sup>, to introduce 5.3 thousand dining-room seats, to accomplish and capital repair and reconstruction of 306 buildings and structures, and to bring the working conditions of 50.6 thousand workers, including 13.5 thousand women, into agreement in terms of all basic factors with the requirements and norms for protection of labor, and to free about 5,000 people from difficult, dangerous work.

Great important in accomplishing the tasks facing the branch during the 11th five-year plan is given the implementation of the measures provided for in the decree of the CC CPSU and USSR Council of Ministers "Improving planning and increasing action of management mechanism on improving production efficiency and work quality", which are aimed toward:

- the widest possible distribution of the team form of organization and labor simulation;
- a transition in planning industrial production to new indicators, including for normatively pure production;
- expansion and development of direct long-terms management relationships;
- providing cost-accounting methods of activity and normative distribution of profit with centralized accounting according to payments to the State Budget from profit;

--more effective action of material and moral incentives and thorough optimization of high-quality economic indicators of the activity of enterprises and organizations, using methods of thorough systems analysis of the state of affairs and critical interpretation of results, followed by practical conclusions.

The execution of the huge problems facing the construction, road and utility machine building branch is undoubtedly realistic, but timely, energetic work of all branches of production management and all workers in the plants and organizations of the Ministry on their group of problems is required.

Important assistance in this matter must be provided by the press organ of Minstroydormash - the journal STROITEL'NYYE I DOROZHNYYE MASHINY, which must attract the widest possible participation of correspondents, specialists of enterprises and organizations of its own branch as well as technology consumers, and put forth unresolved problems, disclose the factors hindering the execution of programs in a businesslike manner, present the working experience of branch collectives and leaders in socialist competition, and herald everything which is progressive.

The collectives of the associations, enterprises and organizations of the Ministry, implementing the resolutions of the 26th CPSU Congress, ensured increased efficiency of production and quality of work, and on this basis the fulfillment of the basic tasks of the State Plan for Economic and Social Development of the USSR. The annual plan for the realization of production by the Ministry was fulfilled by 100.9%. By comparison with 1980, the amount of production of manufactured goods increased by 3.2%, while labor productivity increased by 3.8%. The entire increase in the amount of production was achieved through improved labor productivity.

The assignment regarding the proportion of top-quality production within the overall volume of production was fulfilled.

The collective of Minstroydormash, together with all of the Soviet people, entered the second year of the 11th five-year plan with indisputably more complex tasks and problems.

The successful completion of the plan for 1982 and early fulfillment of plans for the entire five-year plan require, besides intensive work on the part of the collectives of all of the enterprises and organizations of the branch, the creative attitude of branch workers, and steadfastness and timely work.

To be abreast of the problems which are facing us means to accomplish the resolutions of the 26th CPSU Congress and thus to determine the contribution of the branch as one of the regions of the national economy, which will ensure a wider scope in the development of capital construction and many other branches of the country.

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## CONSTRUCTION MACHINERY

### IMPROVE OPERATING EFFICIENCY OF CONSTRUCTION MACHINERY

Moscow TRANSPORTNOYE STROITEL'STVO in Russian No 10, Oct 81 (signed to press 9 Sep 81) pp 1-2, 24

[Article by A.P. Garkusha, deputy minister of Transportation Construction]

[Text] An important role is played in solving the problem of increasing the rates and improving the quality of transportation construction by mechanization automation and electrification of construction production in combination with skillful and conservative use of machinery, mechanisms and motor transport. It is sufficient to say that the increase in labor productivity during 1980 due to factors associated with increasing the level of mechanization amounted to 19.4%; the same increase through improved utilization of machinery and equipment amounted to 9.0% of the total labor productivity growth indicator for the ministry: for Glavdorstroy these indicators were 21.7 and 12.9%, respectively; for Glavmorrechestroy - 20.8 and 18.1%, and for Glavtranselektromontazh - 20.7 and 13.4%. As we can see, as a result of measures associated with mechanization of construction and installation operations, the ministry achieved almost one-third of its increase in labor productivity, which is of major economic significance.

Extensive mechanization of construction and installation operations is also of major social and political importance. It frees workers from heavy, exhausting manual labor, provides unlimited possibilities for the spiritual development of Soviet man, and increases interest in labor and its results immeasurably.

The construction subdivisions of Mintransstroy are adding new machines and mechanisms annually. By the end of the 10th five-year plan, more than 66,000 pieces of basic construction machinery were in operation at our sites, which is 10% more than at the beginning of 1976. The branch's machinery pool contains over 4.7 thousand single-bucket excavators, 10.5 thousand bulldozers and tractors, and about 7.5 thousand different cranes. Road building organizations have available high-efficiency imported systems as well as domestic "Avtogreyd" machines.

The machinery pool at our sites is being supplemented primarily with mechanisms having higher unit capacity, which has made it possible to improve that indicator over the five-year plan for excavators by 0.052 m<sup>3</sup>, for bulldozers by 8 hp, tractors by 21.4 hp, dumptrucks by 0.93 tons, truck-mounted cranes by 1 ton and pneumatic-tired cranes by 1.5 tons. In connection with the changing geography

of construction and installation operations, machinery configured for use in the north is being utilized increasingly in transport construction.

As a consequence of technical re-equipping resulting from providing the branch with powerful high-output machinery, the extensive utilization of small mechanization facilities, improving the level of mechanization of construction and installation work and the creation of a well developed centralized repair base, the degree of mechanization of construction within Mintransstroy increased from 0.28 in 1976 to 0.33 in 1980, while the mechanization of labor increased from 4.1 to 5.46. The subdivisions of Glavbamstroy, Glavmorrechstroy and Glavmostostroy all have improved construction and labor mechanization indicators. The power supplied per job in transportation construction also increased significantly.

In connection with the constant increase in scope and growing complexity of construction and installation work, and the urgent requirement for reducing manual labor in all possible ways, the problem of maximal utilization of the existing varied construction technology is now especially important.

As a result of the organizational and technical measures which have been taken, the time utilization of the main construction machines as a whole for Mintransstroy was improved over the past five-year plan. For example, the average daily length of operation in 1980 was improved over 1976 by 6.4% for excavators, 6.6% for bulldozers, 8.4% for scrapers, and 7.7% for tracked cranes. The time utilization of excavators by the Ural and Siberian GUZhDS [Chief Directorate for Railroad Construction] (12.1 hours), Glavbamstroy (2.9 hours), Glavzapsibdorstroy (11.9) is better than by other chief directorates; the same is true for bulldozers at Glavtonnel'-metrostroy (12.4 hours), Glavmorrechstroy (12.3 hours) and Glavmostostroy (11.6 hours).

Actual production was increased for scrapers by 11.8% and bulldozers by 20% over 1976.

Considering the daily amount of machinery operation, the shift work coefficient also improved during the five-year plan. Specifically, it increased by 6.6% for excavators, reaching 1.46 in 1980, 6.0 and 1.40 for bulldozers, respectively, and 9.0 and 1.45 for scrapers. The highest shift work coefficients for excavators and bulldozers were achieved by the construction subdivisions of the Ural and Siberia GUZhDS (1.51 and 1.45), Glavmorrechstroy (1.46 and 1.51) and Glavmostostroy (1.46 and 1.50).

The concentration of earthmoving machinery at large specialized excavation trusts made it possible to improve the organization of their work significantly by creating standard excavating complexes, providing a high degree of specialization of mechanized columns and professional training of operators, which helps to improve the operating efficiency of construction equipment. It is therefore no accident that the output of excavators and bulldozers in these trusts exceeds the ministry average by up to 30%.

Lost working time per shift of basic construction machinery and mechanisms due to down time was reduced somewhat during the 10th five-year plan. While these losses comprised 14.7% of all machinery working time in 1975, this figure was reduced to 11.6 % in 1980.



The high level of mechanization (up to 99.4%) and integrated mechanization (up to 99.98%) of basic labor consuming operations made it possible to realize the planned assignments to reduce the amount of work done manually per million rubles. For example, while the 1980 plan called for reducing manual excavation work by 24% (to the 1975 level), the actual reduction was 25.9%. For loading and unloading sand, rubble and rock, these indicators were 25.0 and 29.5%, respectively, 22 and 34% for construction structures, and 28.0 and 32.8% for cement.

The increased level of mechanization of construction and installation operations, the widespread introduction of small mechanization facilities and the high degree of mechanization and power availability in transportation construction have made it possible to reduce the proportion of individuals doing manual labor from 39.7% in 1975 to 37.4% in 1979 (not counting workers who operate machinery manually).

In accordance with the new equipment plant, industrial enterprises belonging to the branch provided series production of 54 items of machinery and mechanisms amounting to 850 units. The most important of these included the BTS-500 drilling machine, which has a roller cutting tool for drilling 0.5-meter wells in permafrost, a vibrating tamper for compacting bulk in tight spaces, a machine for stabilizing the banks of dirt road beds by hydraulic seeding with grass and mulching, the ZS-400 rail-section assembly machine which is used to assemble 25-meter rail sections and wooden ties, and the PPZL-650 rail section device which installs these sections, the ELB-ZTS electric ballast machine with straightening device, the continuous PM-400 tie tamper, a trenchless cable layer, a type 400±70 suction-tube dredge without output of 400 m<sup>3</sup>/hour, a BTK-5M bulldozer-pipe layer built on a T-130 tractor, a stationary tubing installer for column-type stations, the DK-63 63-ton derrick crane for bridge building, and many others. The annual savings from introducing the new machinery and mechanisms totaled more than 19.360 million rubles during the past five-year plan.

Nonetheless, there are still serious shortcomings and significant untapped reserves in the utilization of machinery and mechanisms, improving their operating efficiency and ensuring further increase in the level of mechanized labor, which undeniably delays the rate of growth of labor productivity in the branch.

For example, unsatisfactory utilization of construction equipment, particularly high-capacity expensive machinery, by a number of chief directorates was one of the main reasons for an 11% drop in capital productivity during the 10th five-year plan.

The time utilization indicators for machinery at some chief directorates were significantly below the average ministry levels; in some cases they remained at the 1976 level, or even dropped below that. For example, the Northern and Western GUZhDS had excavators operating an average of 10.7 hours in 1980, and 10.8 hours in 1976; the same numbers for tracked cranes were 10.1 and 10.4 hours. The average operating hours for bulldozers at Glavbamstroy was 10.5 hours in 1980 (with a ministry average of 11.3 hours), while that figure was 11.6 hours at the beginning of the 10th five-year plan. The time utilization of individual mechanisms was

also worse at the Volga and Southern GUZhDS (power cranes), the Kazakhstan and Central Asia GUZhDS (pneumatic-tired cranes) and Glavdorstroy (excavators, bulldozers and truck-mounted cranes).

The coefficient of shift operation for certain machinery was also significantly lower than at the beginning of the past five-year plan in subdivisions of some chief directorates. For example, at Glavbamstroy, this indicator was 1.31 for bulldozers in 1980, as compared with 1.45 in 1976; these figures were 1.27 and 1.33, respectively, for Glavdorstroy.

Checks made at individual trusts and construction directorates indicate that there have been cases in which the average branch shift downtime indicator has been exceeded significantly.

Analysis of the structure of intra-shift losses indicates that about 80% of all machine downtime is caused by shortcomings due to the construction organizations.

Due to violation of labor discipline alone, the machine downtime in 1979 was over 12%, and 10.3% in 1980, of the total amount of lost working time.

Idle time by good equipment is unacceptably high; such downtime even exceeded the 1976 levels for a number of important machines in 1980. For example, downtime for operable excavators in 1976 amounted to 23.3%, while this figure was 25.7% in 1980 of the total availability time; the same figures for bulldozers were 21.3 and 27%, and 22.9 and 24.8% for truck-mounted cranes. The absolute amount of downtime at the end of the five-year plan for excavators, scrapers, bulldozers and cranes alone amounted to 1914.2 thousand machine shifts, which is 14% higher than in 1976. The idle time of working machinery is significantly higher than the average ministry indicators in some construction trusts and directorates.

Our operators still have not been able to fulfill the annual directive norms for the output of basic construction machinery, even though this indicator did improve somewhat for certain machines (scrapers and bulldozers) during the five-year plan. In particular, excavators fulfilled the directive output norms in 1980 by 92.3%, bulldozers by 96% and tower cranes by 84.7%. Last year the smallest excavator output was achieved by Glavdorstroy (73.4%), the Ural and Siberian GUZhDS (89.5%); the smallest figure for bulldozers was achieved by the Kazakhstan and Central Asia GUZhDS (53.1%), and the Ural and Siberia GUZhDS (64.3%); the smallest figures for tower cranes were achieved by the Northern and Western GUZhDS (50.5%). Analysis of reporting data and results of checks made indicate that excavator output ministry-wide dropped by a total of 1.8% in 1980 as compared with 1976; for the Ural and Siberia GUZhDS this figure was 7.4%, and 2.4% for Glavbamstroy. With an average ministry-wide increase of 29% in bulldozer output, the output for the Ural and Siberia GUZhDS dropped by 9.2%, and by 24% for the Kazakhstan and Central Asia GUZhDS.

Organizations of Glavdorstroy, Glavzapsibdorstroy, the Kazakhstan and Central Asia GUZhDS and Glavbamstroy are switching machinery over to multi-shift operation very slowly.

Significant numbers of machines are operating for two and three shifts in construction organizations where the supervisors have devoted the required attention to switching machinery over to multi-shift operation. For example, the excavator and bulldozer pool belonging to Uralstroymekhanizatsiya operated for only two or three shifts; this was true for 95% of the excavators and 87.2% of the bulldozers belonging to Chernomorgidrostroy. These figures were 91 and 80%, respectively, for Tsentrostroymekhanizatsiya, and 89 and 79% for Sevzapmorgidrostroy.

Unsatisfactory loading of construction machinery in some chief directorates leads to an increase in the level of manual work. For example, the assignments to reduce the amount of work done by hand (calculated per million construction-installation operations as a percentage of the 1975 level) were unfulfilled in 1980 by Glavmorrechstroy for excavation work, by Glavbamstroy and Glavzapidorstroy for loading and unloading non-metallic materials and cement, Glavmostostroy for concrete and the Ural and Siberia GUZhDS for plastering work.

One of the most important indicators of the operating efficiency of construction mechanisms - their technical availability coefficient - remain practically unimproved for the most important machines. As of 1 January this year, this coefficient was 0.825 for excavators, 0.816 for bulldozers, 0.862 for truck-mounted cranes and 0.804 for motor graders. The coefficient of availability is below the average ministry indicators in the following cases: excavators at the Ural and Siberia GUZhDS and Glavzapsibdorstroy, bulldozers at Glavdorstroy and Glavmorrechstroy, truck-mounted cranes at Glavmostostroy and motor graders at Glavbamstroy.

With an overall reduction in the level of manual labor in transportation construction, this indicator is unacceptably high in heavy general construction projects - masonry (91.7%), roofing (29.8%) and painting (65.2%).

Railroad construction trusts are equipped with expensive high-output track equipment - track layers, ballasters, tie tampers, straightening-tamping-finishing machines (VPO-3000), track lifters, etc. However, the actual output of most track machinery is significantly below the design level. For example, the output of one average machine in 1980 at Transstroymekhanizatsiya was 9 kilometers for PB-11 track layers, 49.6 km for UK-25 track layers; 56,000 m<sup>3</sup> for TsNIIS-URMZ ballasters and 42.4 thousand m<sup>3</sup> for ELB-ZTS ballasters; and 175.3 kilometers for VPO-3000 machines. Track machinery downtime is also high. For example, track layers stood idle for 24% of all working days on site last year at the Ural mechanization directorate; this figure was 34% for electric ballasters. The downtime for electroballasters at the Siberian mechanization directorate was 41%, and 25% for VPO-3000 machines. The main reason for the long downtime of track equipment is the lack of a working front, at the fault of the construction organization.

Obviously, it is time to develop and implement organizational and structural measures, which unconditionally can create real conditions for improving the utilization of track machinery.

Self-supporting mechanization directorates have been functioning in recent years in many construction trusts and directorates. With all of the existing shortcomings in their work and the presence of certain unresolved problems on paying the construction organizations for the services of these directorates, analysis of the activity of mechanization directorates indicates the progressiveness of this form of managing the pool of basic construction machinery. Organization of mechanization directorates should therefore be accelerated within all branch trusts.

Mintransstroy has lagged considerably in fulfilling the assignments for the 10th five-year plan with respect to the production of new machinery, mechanisms and equipment as regulated by the Minister's order No. 258 of 30 December 1976 "Authorization of plan to create and utilize new machinery, mechanisms and equipment for Mintransstroy organizations for 1976-1981". Order No. 258 has been fulfilled to only the 55% level (and 85% for the sum of annual plans) with respect to the number of machines produced. The greatest lag has been allowed to occur in fulfilling the order to manufacture machinery and equipment for excavation work (23.8%), railroad, signalling centralization/blocking and communications electrification (48.1%), and the construction of highways and airports (13.9%), transportation construction cranes (36.1%), and equipment for producing reinforced concrete structures and non-metallic materials (12.5%).

The failure to fulfill assignments for new technology in the area of creating new machinery is a serious retarding factor in improving the efficiency of mechanizing construction and installation work.

As follows from the above data, there are serious shortcomings and important reserves in the work of transportation builders in the area of improving the efficiency and introduction of advanced methods for mechanizing construction and installation work, improving the utilization of machinery, mechanisms and equipment, improving management of the mechanization and production and ensuring increasing labor productivity on this basis. Eliminating these shortcomings and the utilization of hidden reserves is the immediate task of all transportation builders which follows from the Basic directions for the economic and social development of the USSR for 1981-1985 and up to 1990, which requires "...taking measures to reduce manual labor significantly, equip construction organizations with high-output machinery, mechanisms, motor transport, including light trucks, and to utilize them more fully through increasing shift work...."

There is no doubt that transportation builders will take energetic measures to improve the efficiency of mechanization of construction and installation work and to improve the utilization of equipment, thus making a worthy contribution to fulfilling the historic resolutions of the 26th CPSU Congress.

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## METALWORKING EQUIPMENT

### INDUSTRIAL ROBOTS DISCUSSED

Tallinn TEHNIKA JA TOOTMINE in Estonian No 3, Mar 82 (signed to press 9 Mar 82) pp 9-12

[Article by H. Tiimus, doctor of technology, and T. Lehtla, candidate of technology at the Tallinn Polytechnical Institute: "Industrial Robots"]

[Text] In recent years industrial robots have come into massive use in many states. In our country serious steps have also been taken to advance robotization in the national economy. The ESSR Council of Ministers developed the necessary instructions in 1981.

The current world state of robotization can be summarized as follows:

Of the more than 100,000 robots in the world more than half are in use in Japan. Sweden is another highly robotized country. Scores of firms in the major capitalist countries are producing lines of robots. The majority of socialist countries has established centers for robot research. In the USSR scores of robots are produced in small production runs. The first robots have arrived in the ESSR. One of them has been installed for instructional purposes in the Tallinn Polytechnic Institute electrical propulsion department.

The word "robot" comes from the Czech word rob-ori, first used in 1920 by K. Capek in his play RUR (Rossums Universal Robots) to represent an automation. Today the word has come to mean a machine that replaces man. Compared to all other machines robots approximate man most closely in physical, functional, and intellectual abilities. At the same time, an outward similarity to man is unimportant.

Depending on their capacity robots are divided into 3 groups: Those with fixed programs, those with sensors and logical program guidance, and self-programming or so-called intellectual robots.

Currently the industry is mainly using robots of the first group, those with fixed programs, and to a limited degree simpler robots of the second group, those with sensors.

A robot can be divided into various functional components. The most important of these are:

Manipulator--a mechanical arm for performing tasks. The organ has usually 2-6 joints which determine its ability to operate at various points in space; Manipulator servo-mechanism(s)--these enable the manipulator to move in all directions, depending on the number of joints. Either one central servo-mechanism can be used, or  $n$  individual devices for each joint ( $n$ --number of joints).

Manipulator program guidance system--this ensures that previously programmed instructions are fulfilled throughout the operation. Guidance of robots of the second and third generation allow the robot to make independent decisions to deal with situational changes in the work process.

Depending on the application of the robot its lift capacity, positioning accuracy, number of joints, the manipulator's kinematic scheme, type of servo-mechanism, and guidance system can vary greatly.

Compared to programmed coordinated cutting dies robots need not have a particularly precise positioning accuracy. On the other hand, they have to have great operational speed. Robots have to be compact, light, and cheap. These requirements are comprehensively met by selection of the manipulator's kinematic scheme, servo-mechanisms, and guidance system.

The manipulator has, like man, an arm and a hand. The arm movement allows an object to be moved from one point to another. The hand movement permits a positioning of the object as needed. Instead of fingers robots have claws, designed to conform in shape and extent to the object being handled.

To move a robot's arm 4 kinematic schemes are used in the manipulator (Fig 1), differing from each other in the relationship of linear and rotational movement. For example, movement of the manipulator depicted in 1a occurs with the aid of three directional movements. We can talk about the system of various coordinates. Thus a kkk-type robot functions in a system of Cartesian coordinates, a pkk-type robot in cylindrical coordinates and a ppk-type robot in spherical coordinates, while a ppp-type robot functions in a mixed coordinate system.

The movement of the hand in various coordinates is necessary to grasp objects located in various spaces. Usually a robot's hand can rotate in 1-3 coordinates.

The kinematic scheme in use determines directly the technical parameters of the servo-mechanism and the transmission system.

Robots' servo-mechanisms include hydraulic, electro-hydraulic, pneumatic, and electro-mechanical devices. Hydraulic devices use hydrocylinders and hydromotors. Electro-hydraulic mechanisms employ electrical motors with hydraulic amplifiers. In pneumatic devices the mechanical energy is produced by pneumatic cylinders and pneumatic motors. Electrical mechanisms use both direct and alternate current servo-motors, step-motors, linear motors, etc.

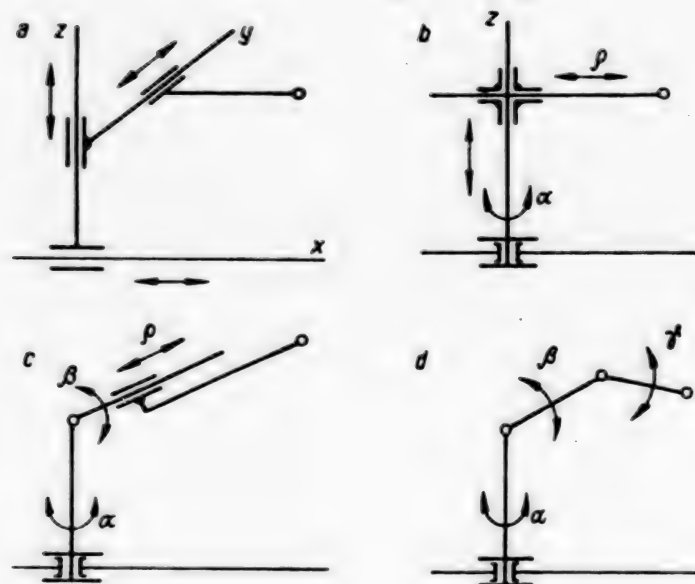


Figure 1. Typical kinematic schemes of robots: a--three linear movements or kkk-type, b--one rotational and two linear movements or pkk-type, c--two rotational and one linear movement or ppk-type, d--three rotational movements or ppp-type.

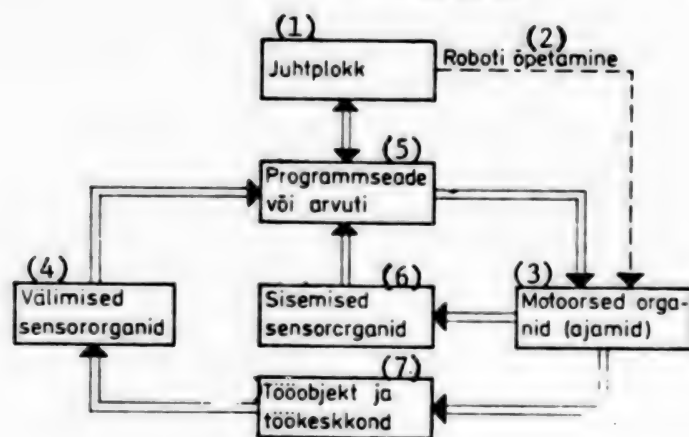


Figure 2. Generalized scheme of a robot's guidance system. The first generation robots lack external sensors

Key:

1. Guidance block
2. Robot instruction
3. Mechanical devices (propulsion)
4. External sensors
5. Programming device or computer
6. Internal sensors
7. Work object and work environment

The required speed of operation, small mass and measurements have been the main reasons that the role of electrical mechanisms as propulsion devices has been fairly limited. Electrical devices are in these respects still outclassed by hydraulic and pneumatic drives. Recently, however, there has been an increase in the use of electrical mechanisms to drive robots. This has taken place thanks to new, highly efficient step and servomotors with low inertia moments, and various special linear motors that can compete with hydraulic and pneumatic drives. Generally electrical devices are considered to be advantageous in lower power areas (up to 10 kW). For greater power hydraulic devices are best. Pneumatic devices are generally used with simpler robots--wherever difficult tasks are to be met.

The guidance system takes care of the robot's automatic functioning. A guidance system in generalized form is depicted in Figure 2.

The control system of first generation robots consists of a control block to exchange information and instruct the robot, a programming device, joint actuators, and internal sensors. The latter include positional and tachometric sensors. Positional sensors assure that the robot is positioned at a precisely programmed point, while tachometric sensors control the manipulator's speed of movement. Positional sensors include widely varying devices--precision potentiometers, photoelectric and inductive impulse sensors, various code sensors, and finally the most common end switches. Tachometric sensors consist basically of tachogenerators.

A control system of a robot based on positional sensors consisting of end switches is the simplest one, but unfortunately its use is limited. Such robots can perform cyclical functions between a few points. Changes in the coordinates of these points are accomplished by adjustment to the end switches.

Control systems based on precision potentiometers are widely used in robots. Here the positioning takes place through a device which is programmed to compare two potentiometric signals (input and feedback). There are also robots that receive their input directly from the program device through a digital code that is transformed into an analog signal by an analog converter.

The use of impulse sensors demands a discrete guidance system. The comparison of feedback signals and input signals occurs through reversible counters. The basic impulse sensors consist of photoelectric (light and photo diode) sensors and inductors (inductive impulse sensors). Impulse sensors assure high levels of positioning precision, if one discards the fact that mistakes made in counting impulses are summed during the operation and can result in quite sizeable deviations. Moreover, a disadvantage of impulse sensors is their relatively high price.

Code sensors are not subject to possible errors in counting impulses, but their construction is more complicated than that of impulse sensors.

Different from all the other robots are those with electrical step actuators that can be positioned precisely even without internal positioning sensors.



Scientists of the Moscow Energetic Institute, directed by Professor B. Ivobotenko, winner of the USSR State Prize, have embarked on a completely new path in constructing electrical actuators. Their aim is to create multi-coordinate electrical actuators for robots, and in this they have already achieved remarkable success. The basic component of such an actuator is a multi-coordinate (usually by-coordinate) electrical step motor that is guided by a microcomputer. For example, bi-coordinate manipulators with planar actuators are used to make semi-conductor integral switches. The deviation of this manipulator is measured in micrometers.

The program determines the robot's skill. Its memory capacity determines directly the number and character of the robot's operation, as well as the type of control system used.

In step with the development of computer memory, programs with ever greater capacity and speed of operation have come into use with robots. In the beginning a complex of multi-positional relay switches was sufficient. Then punch cards, punch tape, and perfo drums came into use. In the latter case a program is transferred to a perforated drum, with one row of punches representing one command. Such rather primitive programs are in use with many robots. Today, however, they must be considered obsolete. Their limitations include small memory capacity, the bulk of the device, high cost, need for mechanical auxiliary devices, and, of course, the programmatic inconvenience.

The next step consisted of magnetic drums and magnetic disks. Currently semi-conductor memory is coming into ever wider use.

Semi-conductor memory on integral switching or memory on floppy disks can greatly reduce the dimensions of the program device. Programming becomes simpler, the memory volume increases, and at the same time the possibilities for robot use expand. The control of the more perfect robots has been entrusted to microcomputers.

The movement of a robot's manipulator between two points can occur via a random or fixed trajectory. In the latter case the robot manipulator's movements are smoother, actuators on various planes commence and conclude their function at the same time, the object is moved along the shortest path, energy use decreases, and speed of operation increases. At the same time this control system requires a large capacity memory.

According to the movement of the manipulator the first type of control system is called a positional guidance system, the latter contour guidance system. The position guidance system is divided into analog and digital guidance system, with the former requiring a considerably smaller memory device; the "teaching" of the robot is, however, more complicated. Robots with contour guidance systems can solve relatively complex problems, such as covering areas with paint or some other surface covering. Guidance systems of robots with end switches or fixed limits are called cyclical.

The table gives a few characteristics and applications of robots made in the USSR and foreign countries.

# Data on Some Industrial Robots Made in the USSR and Abroad

Model	Weight (in kg)	Lift capacity (in kg)	Positioning error, mm	Number of joints	Extent and speed of movement (mm/sec or deg (deg · sec)	Kinematic scheme	Actuator	Guidance system
ML-9	25	0.2	0.2	3	Rotating Lift 300(300)	pkk	Pneumatic	Cyclical 18 step
ML-5	370	15	0.3	4	Horizontal Rotating Lift 150(300) 180(90) 250(250) 600(1000)	pkk	Pneumatic	Cyclical 40 step
ML-3 4 manipu- lators	40	0.5		3	Rotating Lift 125(100) 100(100)	pkk	Pneumatic	Cyclical
MHU Senior Sweden	480	15	0.2	5	Rotating Lift 360(90) 500(300) 1100(1000)	pkk	Pneumatic	Cyclical
Universal 50	1500	50	3	5	Hor rot Vert rot Horiz 900(1000)	ppk	Hydraulic	Analog- positioning 50 step
LR-35		35	2.5	5	Hor rot Vert rot Horiz 57(30) 940(760)	ppk	Hydraulic	Positioning
Kawasaki Unimate Japan	1500	20	2	5	Hor rot Vert rot Horiz 55(30) 240(90)	ppk	Hydraulic	Digital positioning 512 step
Versatran USA	500	45	3.2	5	Rotating Lift 762(914) 762(914)	pkk	Hydraulic	Analog- positioning or contour
Universal 5	650	5	2	6	Hor rot I Lift 800(600) Hor rot II 700(800)	pkpk	Electric	Analog- positioning 50 step

[Table continued on following page]

ASEA Sweden	125	6	0.2	5	Hor rot Vert rot	340(95) <sup>1</sup> 80(750) <sup>1</sup>	ppp	Electric	Positioning or contour
ML-1	400	15	4	5	Vert rot II Hor rot	65(1100) <sup>1</sup> 300(60)	ppp	Electric	Digital positioning 256 step
PR-10M		10	0.3	5	Vert rot I Vert rot II Horiz rot	55(30) 215(45) 220(90)	pkk	Pneumatic	Positioning
PRK-20		20	3	6	Lift Horiz Horiz	200(800) 600(800) 6000(250)	kppp		Contour- minicomputer
PUMA 500 USA	48	2.3	0.1	5	Vert rot I Vert rot II Hor rot	1500 <sup>2</sup> 1500 <sup>2</sup> 180	ppp	Electrical	Contour- computer LSI-11
Unimate					Vert rot I Vert rot II	200 270			

1. mm/sec

2. mm (movement to the side and up)

The ML-9 and ML-5 robots are designed for use in punch presses. The ML-3 robot can do that as well, but since it has four manipulators it can service at least two jobs at the same time. These robots can also be used in the automation of all other jobs, wherever objects do not have to be reoriented in a complex manner (this is limited by the small number of joints--3-4--and a primitive guidance system). The MHU Senior robot falls in the same category of light robots.

The robots Universal 50 (figure 3), PR-35, Kawasaki Unimate and Versatran are mid-range robots. They have hydraulic actuators, five joints, and a relatively sophisticated guidance system. This allows for their more flexible application--for example, in metalworking industry in metalcutting.

There follow in the table robots that have a rather extensive number of joints and a relatively complex guidance system. These robots can be considered universal. In their lift capacity they fall among both light and medium robots. One of the most perfect industrial robots is the Puma 500 of Unimate. The rather light robot in both mass and lift capacity is extremely accurate and it has a flexible large-capacity guidance system.

The most widely used fields for robot application include electrical welding, servicing of presses and metalcutting machines, painting surfaces, operations in metallurgy, galvanizing, etc.

Robot use is justified either by economic factors or a desire to avoid hazardous working conditions for humans. Economically their application is justified in technologies of mid-range production and frequent adjustment, while in the case of large-scale production automated assembly lines are better; manual work can be used in very small production runs.

The near future should bring important changes in robot construction. Electrical actuators are being more used, the program guidance system is being perfected, robots become more reliable and their application more flexible. In connection with the spread of robots there is increased demand for specialists to install and operate robots.

In our republic there will soon be developed a system for training and re-training working and engineer-technical personnel. The Tallinn Polytechnic Institute has established a new branch to solve that task, called "robot-technical complexes and systems of industrial program guidance" within the general electrical propulsion and labor device automation specialty.

After the approval of the modernized curriculum by the USSR Ministry of higher education this field will be open for specialization as early as the 1982/83 school year.

#### PHOTO CAPTIONS

1. p 12. Figure 3. Control pane of Universal 50 robot. 1--punch drum, 2--potentiometers for coordinate input, 3--adjustment panel for technological commands, 4--panel for manual control and robot instruction, 5--control panel for program device.



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## METALWORKING EQUIPMENT

### ASSEMBLY-LINE ROBOTS INTRODUCED FOR WATCH ASSEMBLY

Minsk SOVETSKAYA BELORUSSIYA in Russian 17 Dec 82 p 2

[Article by V. Khil'kevich: "Robot - You're Fired, and Here's a Raise".]

[Text] The Minsk watchmakers have taught an industrial robot a new specialty. With their help, the manipulator has learned to assemble and install still another stopwatch unit. "Iron workers" are now executing about 100 operations at the clock plant.

"The use of manipulators has become possible thanks to long, careful engineering work in mechanizing and automating production. Taken together, all of this has made it possible to increase assembly automation to 6-10%," says enterprise director A.V. Kazantsev on the way to the shop. "On the whole, our labor productivity has increased by 59% over the past five years, prime cost has dropped and product quality has improved significantly. If we mention robot technology, its introduction has provided perceptible social changes, in addition to a solid economic effect. It has freed a number of our women from monotonous, fatiguing labor."

"Freed them or replaced them?"

"The matter is not only the semantic coloring of the term. This is a case in which the social context itself must be kept in mind. Robots have replaced - in the full sense of the word - many people in capitalist enterprises. These people became superfluous not only at the plant, but often in life as well. Go ahead and talk to our girls. See if you can find anyone who has lost out due to the introduction of manipulators."

The spacious first assembly shop is brightened even further by the white gowns. The manipulators, mostly installed in groups, sometimes in pairs, can be seen from afar. We draw near and meet the people watching over them: loading parts and watching the operation. Svetlana Gromak is more inclined to consider the manipulator an associate than a ward. Quickly and surely, she installs the parts in the watch casing, and two steel hands screw them in place. These fingers do not cramp, like the girl's used to from the small screwdriver. Working with her extraordinary associate, Sveta can now do three times as much. She doesn't receive three times as much pay, of course, but she does receive a solid incentive - 40 rubles. We also shall remember that her work has become much easier.

Next is Anna Berzhanina with her "team". She has several manipulators which have "learned" their program well. One of them installs the drum bridge, the other fastens it, a third places drive wheels on the bridge and a fourth tightens them; only a soft clicking is heard, as if they are conversing among themselves: I've done my thing, now it's your turn. This machine has freed five workers.

Who are these people who have been freed by these and other manipulators? And what has happened to their working life?

According to shop chief V.I. Tavkevich, "In the past two years (which is how long we have been actively introducing robots), 55 people have changed their profession. After appropriate training, many are now industrial robot operators. Others have gone into quality control, which is not an assembly line. The work is easier, but the qualifications are higher. It is not enough to know "your own" operation. People are studying well and, accordingly, are earning more.

We talked with Galina Aleynik. She used to be involved in the most unpopular work in the shop - assembling the band and the winding and setting mechanism. She used to install eight tiny parts manually, gathering the pieces together, and none of them even "join". Hands and eyes became tired, the more so because she had to check the quality of completed work carefully. This work is now done by machines, leaving Galina and her co-workers only the monitoring function.

Over 600 lever forks passed through O.M. Denis' hands each shift. Imagine the perseverance needed to install each of them precisely with the required clearance and without becoming exhausted from the assembly rhythm. She now uses optics with 100 power magnification to adjust the clearance between the parts on a projection screen. G.F. Karpovich's work also became more interesting. Karpovich, a calibrator (and not simply an assembler), analyzes and corrects quality defects in all watches returned by the quality control and testing station. The average earnings of a calibrator amount to 180 rubles. These workers comprise the reserve from which foremen and team leaders are developed.

There are many examples of this sort in other shops as well. In one of the mechanical shops, operator R.N. Chuykova smilingly shared the following with us:

"I used to not only work, but "dance" as well. My machine was controlled by means of foot pedals. First you push the left foot, then the right, then the left, then the right, all done standing. When you get home you can't feel your legs. When they said that the section was going to be automated and offered training, I of course agreed. I retained my average pay during training, and now I have two machines which carry out eleven operations at once. It is easier for me because I can sit down if I am tired, and it is more interesting. I have to know all eleven of these operations and I have to be able to use instrumentation: instead of three measuring instruments, there are now 20. My work has changed in substance, and become more mental. My pay has increased. I have been at the plant for 13 years, and the most recent years of working with the machines have been most interesting."

A final question was addressed to the director: "What are the prospects, Aleksey Vasil'yevich?"

"We are holding a course for complete automation. If we free personnel both here and in other branches in time, it will not harm the worker. The state guarantees work to each worker's liking. Of course, this is the long-range perspective. Talking about the short term, we are now teaching the robot to install the calendar assembly in the watches.

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## METALWORKING EQUIPMENT

### SPECIALIZATION IN AREAS OF DEVELOPMENT OF INDUSTRIAL ROBOTS

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 1, Jan 82  
(signed to press 23 Dec 82) pp 35-36

[Article by Bureau Chief A.A. Kozlov]

[Text] The article by Candidate of Technical Sciences V.P. Bobrov entitled "Conditions for introduction of automatic manipulators in machine building" put forth six conditions which, in the author's opinion, should promote intensive and rational automation of production. The conditions consist essentially of the following: for the purposes of unity of terminology, only the term "automatic manipulator" (AM) should be used: AM should be distinguished in terms of their degree of development; AM should be used only where other devices cannot be used; AM should be excluded from the category of nonstandard equipment; the configuration of tools and machines should be re-examined for the purpose of utilizing built-in AM in their designs; the operation of shops and sections should be arranged so as to provide the possibilities for introducing AM.

It is difficult to agree with the first of these conditions because the term "automatic manipulator" is used to designate first-generation industrial robots, i.e., simple constructions which manipulate a part or tool according to a fixed program. It is therefore better to use the term "industrial robot" (IR), since it is more general and allows for the current status of robot technology as well as prospects for its further development.

As concerns the second conditions, IR are now divided into generations: the first includes automatic manipulators, the second includes sensitized IR, i.e., IR equipped with transducers which permit emergencies to be avoided, the third includes IR with adaptive control - robots which can adapt to some extent to changes in the working situation; the fourth generation includes intelligent robots, usually equipped with a computer and capable of solving a wide group of problems which are outside the scope of simple program control. However, this classification refers only to control systems, and does not allow for the features of the basic executive component of the robot - the manipulator. In addition, modern IR are characterized by a wide variety of manipulating organs, which results from the specific nature of their use in different spheres of industrial production. It is therefore best to classify IR in terms of the design and type of manipulating organ used, rather than the development of their control system, which

makes it possible to allow more fully for the technological requirements of production in determining trends of further development. In particular, it has been proposed to subdivide IR into three basic groups: the first group includes service IR (robots which execute operations involved in running basic technological equipment: tools, presses, etc.); the second consists of technological IR (robots which execute defined technological operations independently: welding, assembly, application of codings, etc.); and the third group - transportation IR (robots which execute transportation operations between one unit of basic technological equipment and another). The practical use of this classification will make it possible to realize the remaining conditions put forth by V.P. Bobrov.

The overwhelming majority of modern IR, approximately 75% of the total number in existence, belong to the first group of the proposed classification. An example are the "Tsiklon-3B", "Brig-10", RF-202M and other IR models. In evaluating their design features, we can state that the same principles, methods and means were used in creating these models as were used in designing special-purpose program controlled machines. Thus, it has come about that technological equipment (machines) is operated by a device (industrial robot) which is no less complex, and that a system of additional devices and special tools is used as well.

The question naturally arises of whether means for automating auxiliary operations (loading, unloading, part positioning) cannot be provided in advance as a composite part of the machine during the design process. The answer is yes, and there are many examples of this. For example, there are processing-center type machines, and some universal numerical program controlled milling machines are equipped with hoppers and manipulators for automatic tool changing which uses the same hydraulic and control system as the machine. These machines have built-in manipulators for installing, removing and positioning parts during processing, and would represent a complete automated technological complex (ATC). This approach to automating technological processes using IR finally results in the robots belonging to the first group of the proposed classification ceasing to exist as independent pieces of equipment (nonstandard ones at that), but becoming a composite part in an ATC as a built-in machine module. The introduction of such an ATC into production requires only the creation of special-purpose fittings for the specific type of parts, which significantly simplifies automation and mechanization of production processes at industrial enterprises. The main direction of development of service IR must therefore be their further specialization and standardization, while questions of development and use of IR in the first group should be related to the competence of machine builders and developers of basic technological equipment. Using the principle of modular configuration of built-in manipulators, it is effective to create specialized sets of modules which can be used to configure manipulators of the required construction in order to make up a particular type of machine. The program control system must provide the capability of acquiring information from external sensors and controlling the manipulator built into the machine.

Examples of technological IR created in the Soviet Union include the "Kontur-002", the PRK-20, the "UNIVERSAL-15" and others. Analyzing the paths of development of these robots, which refer to the second group in the proposed classification, it should be noted that they can be either specialized or universal, but cannot be

covered by the term "automatic manipulator" as proposed by V.P. Bobrov, because they have a significantly more developed control system. The best direction seems to be further standardization of technological IR, expanding their functional capabilities, increasing the number of mobility stages and improving their control systems. The control systems for IR in the second group must be basically adaptive, based on microcomputers or minicomputers with substantial memory and a flexible programming system. This will make it possible to use standard IR in different technological processes by equipping the technological IR with sets of special attachments and fittings, as well as service IR belonging to the first group. Experience has shown that when IR are introduced into production, the technological process undergoes significant changes, and is often re-created. In addition, it is possible to create a number of new production processes which can be realized using robots. Therefore, technical questions involved with the further development of technological IR must be closely associated with questions of improving the existing and creating principally new technology. Consequently, the leading role in solving the questions of applying technological IR and their further development must belong to the industrial engineers.

Modern transportation IR are characterized by a wide variety of construction features resulting from the specifics of their use in production. For example, the transportation IR which serve a group of machines (RF-204M) differ significantly from the robots used in intra-shop and transportation-warehousing systems ("Sprut-1"). While the RF-202M is a modified RF-202M manipulator equipped with a transportation unit, the transport module is basic to the "Sprut-1" robot. It is therefore convenient to divide transportation IR into two subgroups: the first includes transportation robots which carry out the functions of service robots, while the other is made up of actual transportation robots. Both subgroups are closely interrelated, since they can have standard common transportation units which are considered as the individual manipulator module of the transportation IR in each subgroup. It should be noted that the ordinary transfer arms, such as those used in transfer-arm galvanic lines, have recently come to be called transportation robots. We cannot agree with this, since even though a transfer arm might belong to the category of automatic manipulators, there is no way that it can be called an industrial robot. This is because transportation robots usually have a manipulating organ which allows it to manipulate the part or cargo being moved in a particular manner, while a transfer arm has no more than two degrees of mobility and has no position sensors for the working parts and for the article being moved. Speaking of transportation IR in the first group, it should be noted that because of the specifics of their use they should develop in the same directions as service IR in the first basic group, i.e., they should be specialized and modular, but, in contrast, should have a better developed control system with a large number of channels for communicating with technological equipment. Transportation IR in the second group, on the other hand, should be equipped with a relatively universal working organ mounted on a standard transportation unit, and the control of these IR should be turned over to specialized automatic process control systems.

As concerns the arrangement of shop and section operations, this condition is met almost everywhere when an IR or robot complex based on several IR is introduced into the production process. The current level of development of automatic process control systems and robot technology now makes it possible to design and create

integrated automatic shops and sections. It is necessary to use the group production method for such integrated automation of the small-series production characteristic for many machine building enterprises, making it possible to make the production closer to series production. The extensive introduction of industrial robots into production is possible on exactly this basis, by carrying out a set of organizational and technical measures and making careful technological preparation.

All of the above permits the following conclusions: intensive development of robot technology requires specialization in the areas in which IR are used in production processes (by groups in accordance with the proposed specification), since the development and production of IR are now occupying organizations within different ministries, which operate independently with practically no coordination of efforts in this area, which results in the lack of a unified technical policy in this area: many scientific-research and experimental-design projects are being duplicated in different branches;

--all-union normative materials for the use of IR in production and the creation of new technological processes based on RTC are needed;

--it is necessary to find design treatments in the area of robot technology which are new in principle on the basis of advanced achievements of science and technology.

In our opinion, this approach to the practical development of robot technology will promote a substantial increase in the rate at which work is proceeding on integrated automation and mechanization of production in different branches of the national economy.

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## METALWORKING EQUIPMENT

### STATUS, PROSPECTS FOR APPLICATION OF INDUSTRIAL ROBOTS

Kiev TEKHNLOGIYA I ORGANIZATSIYA PROIZVODSTVA in Russian No 1, Jan-Mar 82 (signed to press 5 Jan 82) pp 1-4

[Article by Candidate of Technical Sciences V.I. Rybak, Institute of Cybernetics, Ukrainian SSR Academy of Sciences]

[Text] The Communist Party and Soviet government ascribe great importance to increasing the production and extensive introduction of industrial robots (automatic program-controlled manipulators). The unceasing attention to this matter results from the existing disproportion between the number of workers involved in basic and auxiliary operations, the high proportion of manual operations (including heavy, harmful and dangerous) in the overall volume of work, the shortage of labor, and the requirement for further increasing labor productivity and product quality.

The large percentage of workers involved in auxiliary operations, as well as the significant amount of basic technological operations which are done manually, are explained on the one hand by the fact that until recently a great deal of attention was devoted to automating basic technological processes in both continuous and discrete production; on the other hand, the automation of manual labor is more complex on the scientific, technological and economic plane of the problem than the automation of many basic technological processes. This is because of the need for replacing not only the worker's hands, but the worker himself with his capability to perceive the environment and to behave appropriately in a changing situation. Only partial scientific and technical solutions have thus far been achieved in the area of automating processes of visual, auditory, tactile and other types of perception and automatic development of goal-oriented system behavior.

According to the data presented in the book entitled Posobiye po primeneniyu promyshlennykh robotov (Applications Handbook for Industrial Robots), which was edited by K. Nod and published by Izdatel'stvo Mir in 1975 in a translation from the Japanese, the percentage of workers involved in the non-production sphere was approximately as follows in 1870: US - 25%, France - 21, Japan - 10%; in 1900 - 35, 27 and 18%, respectively; in 1930 - 44, 33 and 27%, respectively; in 1960 - 60, 36 and 37%. According to forecast estimates, this growth trend will hold for the coming decades.

During the 9th five-year plan, the absolute increase in the number of workers in industry in this country amounted to half the increase in the non-production sphere. Besides the redistribution of labor resources, labor shortages during the 11th and 12th five-year plans will be caused by an overall reduction in the increase in the number of workers (by more than a factor of 3 in comparison with the 10th five-year plan) in connection with the present sharp reduction in population increase, which is associated mainly with individual consequences of World War II.

Definite experience has now been gained both here and abroad in creating and utilizing industrial robots. Over 50,000 industrial robots are in operation around the world, more than 2000 of which are in this country. Japan occupies the leading position in the world in terms of numbers of robots produced and utilized - about 80% of the entire world industrial robot pool.

According to data from the Japanese Industrial Robot Association, about 42,000 industrial robots were produced in 1978 in Japan, costing on the order of 0.5 billion dollars. According to forecast data, industrial robots worth over 1.3 billion dollars will be produced in 1985.

The USSR is now producing more than 60 different models of industrial robots. However, according to data from the machine building branches, the requirement for even the simplest industrial robots now stands at 25,000 units.

Branch specialization has been defined with respect to the production of industrial robots and equipment systems equipped with robots, and with respect to providing their component articles and spare parts, which will result in organizational ordering of the production of industrial robots. For example, the enterprises of Minstankoprom will be producing industrial robots for metal-cutting, pressing, casting, woodworking and assembly equipment, transfer arms for galvanic coatings, metalworking, woodworking, casting and galvanic equipment systems equipped with industrial robots, hydraulic drives and hydraulic equipment, pneumatic drives and pneumatic equipment for industrial robots; the enterprises of Minkhimmash will be producing industrial robots and equipment systems for painting, etc. In accordance with the specialization, there are provisions for the branches to create special industrial robots for automating technological processes at departmental enterprises.

The Ukrainian SSR is planning to expand the Minstankoprom pneumatic equipment plant of the "Pnevmatika" production association at Simferopol', the industrial robot production shop at the Minelektrotekhprom special technological equipment plant at Cherkassk, the industrial robot production shop at the Mintyazhmash assembly line construction plant at L'vov. There are also plans to construct a special technological equipment production plant at Yagotin, and an experimental Minzhivmash automatic manipulator production plant at Odessa.

There are plans for machine-building enterprises to create model automated shops and sections equipped with industrial robots, including 14 enterprises within the Ukraine, during 1981-1985.

The widespread introduction and operation of industrial robots and robot technological systems, the number of which will soon reach tens of thousands, requires the creation of a startup-adjustment organization for their installation and cen-

tralized servicing analogous to the existing organization for installing and servicing computer facilities. It is difficult to expect extensive introduction of industrial robots and robot technological systems through the efforts of the user enterprises themselves. In order to do this, they have to create special services, which are difficult to staff with specialists. In addition, the lack of centralized service makes it difficult to organize equipment repair and parts supply.

In order to solve properly the problem of creating, introducing and operating industrial robots and robot technological systems, it is necessary to arrange the training and retraining of engineering and technical personnel and the training of working qualifications specialists within the system of higher and middle special training institutions and professional-technical schools. This training of engineering personnel in robot-technical specializations has already been started in the Republic by Minvuz UkrSSR.

In accordance with the decree of Gosplan UkrSSR and the Presidium of the UkrSSR Academy of Sciences of 26 March 1981, a Republic scientific-methodological council for the dissemination and generalization of advanced achievements and coordination of work on the creation and introduction of manipulators and automated technological equipment systems has been created on social foundations under the leadership of UkrSSR Academy of Sciences Academician V.M. Glushkov, director of the Institute of Cybernetics of the UkrSSR Academy of Sciences. Regional sections of the council have been created at the scientific centers of the UkrSSR Academy of Sciences. The tasks of the council include defining a unified scientific and technical policy in the area of creating and utilizing robots and robot technical systems, coordination of scientific research and planning and development work conducted by scientific-research and development organizations within the Republic, and generalization and dissemination of advanced experience in creating and utilizing robots and robot technical systems.

Experience exists within the Republic, in individual regions, with coordination activity in creating and introducing robots and robot technical systems begun at the initiative of the oblast and city committees of the Ukrainian Communist Party. In some oblasts, this activity has taken on a definite organizational form. For example, a consultation and coordinating center for robot technology has been created within the council for the cooperation in scientific-technical progress of the Nikolayev Oblast Party Committee. This council includes a methodological office, a social development bureau, a permanent exhibition of technical robot facilities, a diagnosis and repair methods training laboratory, a library and technical documentation archive. The center studies the demand of oblast enterprises for industrial robots and renders practical assistance to enterprises.

Study of the Nikolayev experience indicates that the creation of such centers can be extremely effective for expanding the scope of introduction of robots by organizing assistance for enterprises in selecting types of robots and ancillary devices.

However, it is clear today that the extremely broad group of problems facing robot builders and users cannot be solved on social foundations. It is necessary to resolve the question of creating a Republic Robot Technical Center on a shared basis by the interested branches. The priority tasks of such a center might be

the following:

- creation of a base complex of robot technical systems for doing scientific-research work, demonstrating the capabilities of robots, training and retraining personnel and conducting courses to improve specialist qualifications;
- creating a continuously updated computer data base on industrial robot and robot technical systems;
- creating a modern information retrieval system with real-time access by telephone;
- coordination and support of work of regional consulting and coordinating centers;
- communicating with robot developer enterprises in this country and in member countries of the Council of Mutual Economic Assistance.

The scientific-methodological supervision of such a center could be managed by the Republic scientific-methodological council.

An important role in ensuring accelerated development of work to create and introduce industrial robots is played by scientific research and development in the area of robot technology within the institutes of the Ukrainian Academy of Sciences, Minvuz UkrSSR, and the institute and design organizations of a number of branches.

The Electric Welding Institute imeni Ye. O. Paton has created the IES-690 contact spot-welding robot, which was installed in 1981 in an experimental section of the "Krasnyy ekskavator" production association for welding tractor cab units. The Institute of Technical Cybernetics and Robotics, in conjunction with the Bulgarian Academy of Sciences, has created a robot technical complex for arc welding, which was awarded a gold medal at the Plovdivskaya Fair in 1980.

The Institute of Cybernetics of the UkrSSR Academy of Sciences has work under way on new generation robots. The country's first model of an autonomous manipulation robot which exhibits goal-oriented behavior based on processing visual information about the outside world was created in 1977. Programs have been developed for sorting a limited nomenclature of industrial parts on a conveyor. The introduction of the results of this work into the national economy during the 10th five-year plan produced savings exceeding two million rubles.

Important results in creating new generations of automatic manipulators have been achieved in institutions of higher learning in the UkrSSR. For example, the Sevastopol' instrument building institute has created industrial models of modular assembly robots, and the Kiev polytechnical institute has developed a standard autonomous control system for assembly equipment which installs radio components on printed circuit boards.

Robot technological complexes are also being created by branch institutes. For example, four types of systems designed for plastic, stamping and mechanical working production have been developed by the "Kommunist" production association. Cold-stamping, mechanical working and casting systems are being created by the "Stroydormash" production association in Kiev. Robot technological complexes for stamping and pressing equipment are being developed and introduced by NIPTMash in Novokramatorsk.



Scientific research underway in the Republic, the training of specialists in robot technology, the coordination of scientific-research and experimental design work, the creation of a production base and the resolution of organizational problems will help to reach a successful solution to the problems involved in creating and assimilating industrial robots and robot technical systems - an important link in accelerating scientific and technical progress.

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## METALWORKING EQUIPMENT

### EFFECTIVENESS OF FOUNDRY RE-TOOLING

Kiev TEKHNLOGIYA I ORGANIZATSIYA PROIZVODSTVA in Russian No 1, Jan-Mar 82 (signed to press 5 Jan 82) pp 18-20

[Article by Doctor of Technical Sciences A. N. Tsibrik, Institute of Foundry Problems, Ukrainian SSR Academy of Sciences]

[Text] More than 30% of all castings are now made without labor-intensive mechanical working (80% of which are iron castings, and 20% steel); this figure may be increased to 50% or more in the future. The average proportion of cast parts in metalworking, forging and pressing and metallurgical equipment is now reaching 80%. According to forecast data, no reduction in the proportion of castings is foreseen in many types of equipment, since only castings can reduce vibration and improve the process ng accuracy and operating characteristics of machines.

The production of castings in this country has reached 1/3 of world production (amounting to 25 million tons per year) and is growing annually; however, the demand of the basic branches of industry is not being met. The specific consumption of fuel and power, material and labor resources is extremely high in foundry production. Foundry production consumes about 40 million tons of charging materials and 30 million tons of moulding materials, 4 million tons of coke and 300 thousand tons of organic binders annually.

Analysis of the construction of the machines and mechanisms used in metallurgy, mining industry, agriculture, forging and pressing, mechanical working and other types of equipment, all of which uses a great number of castings, indicates that regardless of numerous modernizations of existing machines and the production of new designs over the past 30-50 years, the strength, metal consumption and other parameters of castings in the basic nomenclature have remained unchanged. The large number of foundries (over 6000) remain scattered among various departments; the low unit capacity and low level of perfection of smelting equipment, the thermal efficiency of which varies from 6% (for electric furnaces) to 40% (for cupolas) remain unchanged. Many plants have several foundries in operation simultaneously which have a complex production cycle, require a large amount of manual labor and pollute the environment with industrial byproducts and effluents.

On the basis of joint developments by the department for the physical chemistry of moulding materials of the Institute of Foundry Problems of the Ukrainian SSR

Academy of Sciences and the Verkhnedneprovsk Mining and Metallurgical Combine a beneficiation plant has been built and operated for over six years which produces more than 1.6 million tons of high-quality quartz sand annually. Labor productivity at this plant is three times greater than that at existing open-pit workings. The production of washed moulding sand at the combine instead of mining natural sand in the specialized open pits belonging to the "Soyuzformomaterialy" trust has been very effective on the national economic scale: the integration of developing deposits and utilizing the products from beneficiation of polymetal ore sands has increased, it has become unnecessary to build "tailing storage areas" and to produce natural moulding sands at specialized open-pit mines, the amounts of confiscated land, including agricultural land, has been reduced, etc. The technical and economic effect from introducing this measure has amounted to 16 million rubles annually.

Because of the severe shortage of moulding sand, it is essential to increase the capacity of the Verkhnedneprovsk Mining and Metallurgical Combine for producing high quality washed sand during the 11th five-year plan.

In conjunction with plants in the Republic, the department of the physical chemistry of moulding materials of the Institute of Foundry Problems of the Ukrainian SSR Academy of Sciences has developed technology for centralized preparation of high quality molten metal. This new technology uses blast-melted pig iron instead of the secondary smelted iron obtained directly in foundries using the traditional technology. The molten metal is collected, processed and transported in high-capacity mixers.

The iron can be held in its molten state in high-capacity mixers for several days. Long-distance transportation of the molten metal thus depends primarily upon railroad traffic, and can range as far as 400-500 km under favorable conditions. The use of blast-melted pig iron makes it possible to eliminate the production of special cast pig iron, to increase blast furnace output by 20-25%, to eliminate unrecoverable losses of metal during pouring (2-4%) and to reduce the material, energy and labor consumption involved in producing iron at metallurgical plants. The direct use of blast-melted iron in foundries eliminates secondary re-smelting of the metal in electrical and blast furnaces, and allows it to be used as a molten charge for steel conversion, which provides annual savings of about three million tons of coke and up to 1.5 million tons of metal, to increase casting quality and to eliminate harmful effluence into the environment.

Automated smelting complexes based on metallurgical blast furnaces (hot blast) with capacities of between 50 and 100 t/h of molten iron with high re-heating temperature and with efficiency reaching 75% are widely used abroad.

Foundry production in the USSR now uses mainly low-capacity (3-20 t/h) cold blast cupolas with lower efficiency (30-40%) in which it is very difficult to obtain high quality molten iron because of the continuously degraded quality of the charge, coke and flux. By contrast, metallurgical cupolas are less demanding in terms of charge quality, which makes it possible to reduce significantly the labor intensity of cropping and preparing the scrap and of recovery. The metal

charge used can consist completely of scrap metal, including up to 100% steel scrap and up to 25% metallized pellets; the iron obtained has good physical and mechanical properties and fluidity. The mechanical properties of iron smelted in a metallurgical cupola are usually better than grade SCh20. More than 80% of all castings have iron property reaching the level of this grade. At the same time, it is very difficult to achieve this grade of iron in cold blast cupolas; these facilities generally produce ungraded and low-grade SCh10-SCh18 iron, with inoculation used to obtain higher grades. The continuous smelting process in metallurgical cupolas can blast for several months (as compared with less than 16 hours in ordinary cupolas). These cupolas have the highest degree of utilization of waste and completely satisfy the requirements for protecting the environment against harmful effluence; they are therefore recommended for centralized preparation of molten iron in regions located far from metallurgical centers.

The technical-economic and social effect from centralized manufacture of molten iron for foundries in industrial regions is exceptionally great. For example, the implementation of this method in Kiev will make it possible to improve the environment of the city significantly and to achieve savings of over 10 million rubles annually.

In accordance with a decree from Gosplan UkrSSR, the Presidium of the UkrSSR Academy of Sciences and the collegium of Minpromstroymaterialy UkrSSR, the Voroshilovgrad Mechanical Foundry Plant is now being prepared for industrial assimilation of technology for producing cast-iron sections of heating radiators from molten pig iron produced by the Kommunar Metallurgical Plant.

Industrial utilization of first-melt metals in foundry production is to be expanded during the 11th five-year plan in the Dneproptrovskaya Oblast (DZMO Plant imeni Petrovskiy), Donetskaya Oblast (NKMZ), Voroshilovgradskaya Oblast' (VLMZ imeni Artem, KMZ, VTZ), Zaporozhskaya Oblast ("Zaporozhstal"), and Khar'kovskaya Oblast, where foundries are located near metallurgical enterprises and are able to obtain primary metals in molten form.

Interdepartmental centralization of smelting based on modern high unit capacity smelting equipment must be developed as much as possible in oblasts which are far from metallurgical centers, primarily Kievskaya, Khar'kovskaya and Odesskaya.

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## METALWORKING EQUIPMENT

### RE-TOOLING OF PLANTS DISCUSSED

Moscow PRAVDA in Russian 5 Feb 82 p 2

[Article by D. Palterovich, doctor of Economic Sciences, senior scientific worker of USSR Academy of Sciences Economics Institute "Machines Have Their Own Measure"]

[Text] We hear from time to time from factory people that there is not enough equipment. If, say, we add together the annual orders for lathes, we obtain a figure which far exceeds their production nationwide. Are there really not enough? However, it takes only a walk through some shops to be convinced that the shortage of many types of equipment is imaginary. Equipment often stands idle, or is operated for only one shift. Why is this? There are more work stations than workers. The consequence? A sharp reduction in the shift-work factor. In addition, we produce more of some kinds of machines than we need if utilized correctly. The principle of "the less the better" is very successful here. In order for the equipment to become better, less of it must be produced, and then innovations will be put into use more rapidly.

Machine building in this country plays a decisive role in re-tooling the national economy on a new technical base. Approximately 3.7 thousand models of machines, equipment and devices are created annually, and over 1.8 thousand automatic lines are put into use. The production of machine tools using numerical control reached the 10,000 level last year. The production of this equipment will increase significantly by the end of the present five-year plan.

It would seem that progress is at hand. However, machine building has been lagging behind the requirements of the economy in recent years. This is intolerable, especially in connection with the important role which machine building plays in the economic and social development of the country. This lag retards the rate at which obsolescent and worn out equipment is replaced and delays the integrated mechanization of production.

Important requirements for machine building were expressed at the 26th Party Congress and the November (1981) Plenum of the CPSU Central Committee. In particular, the insufficient rates of creation and introduction of new technology, and the fact that its cost is increasing faster than the cost of production, were

indicated. A number of modern devices for mechanizing agriculture, coal and light industry and certain other branches are lacking. Many machines consume excess energy and fuel, and their quality and reliability are often low. The repair base is scattered, and there are not enough spare parts.

The tasks which have been set for machine building for this five-year plan are the greatest in the history of our economics. Furthermore, their accomplishment is made more difficult by the known limitations of labor and material resources. A relatively large proportion of these are required to resolve social and economic problems, such as providing foodstuffs and providing the population with high quality goods and services.

Under these circumstances, it is of decisive importance to find so-called resources, economic paths and directions for the development of machine building. The most important of these is to improve structural policy. This means eliminating disproportions in the branch and organizational structure of machine building, and also in the technological, functional and standard dimensional structure of the equipment produced.

A special role in conserving all types of resources, including labor, is played by observation of rational proportions between technologically related types of equipment. An increase in the number of machines above the optimal requirement usually leads to poorer utilization and a drop in capital productivity.

Take construction as an example. Machine builders have done a great deal to equip this branch. More than 40,000 excavators, and even more bulldozers, are being produced annually, and the demand is being met for the most part. Overall, the pool of critical construction machinery has increased by approximately a factor of 2.3 over the past 15 years, and their capacity has increased substantially. However, the output per machine has increased insignificantly. It is the case in many construction trusts that the larger the earthmoving machines, the more poorly they are utilized.

The amount of mechanized tools available for builders does not meet current requirements. Most workers involved in roofing, finishing and erection work are using manual labor, even though the introduction of "small mechanization" produces a significant effect and, we might point out, very rapidly. Ten mechanical tools costing a total of about 1000 rubles can, on the average, replace a worker. As an example, in the past five-year plan, the "Vostokmetallurgmontazh" trust was able to replace the labor of 150 men and to improve the working conditions of 800 workers through this approach.

However, only about one-third of the demand of builders for mechanical tools is being met. Might it not be better to divert some of the facilities for increasing large-scale production to providing machines for finishing operations and mechanical tools? The requirement for earthmoving technology should be satisfied by improving its quality and increasing the level of utilization.

Problems such as these are also inherent in the arsenal of metal working equipment where cutting machines predominate. However, little equipment is being produced for foundry and assembly operations, where there is still a great deal of manual labor, much of it heavy. Would it not be better to point machine building in the direction of accelerating the introduction of progressive metalworking methods, including pressure treatment? Reducing the amount of excess metal cutting equipment will make it possible to free up some resources in machine tool building which can then be used to equip foundry, assembly and other production.

An important structural shift should result from increasing the proportion of equipment used for auxiliary operations, primarily hoisting, transportation and warehousing. The amount of technical equipment for these operations is several times lower than for basic operations. In addition, it costs two or three times less to replace an auxiliary worker than a primary worker.

In addition to functional structure, the dimensional and performance structure of machines needs to be improved. The possibility of rational operation depends upon rational proportions between machines with large, medium and small power, capacity and other technical parameters. This means that the technical capabilities provided by the machine designs will be utilized more profitably.

Nonetheless, in practice these proportions often do not meet the requirements. There are usually more medium-capacity machines than are needed, and higher and lower capacity machines are not produced in sufficient numbers. As a result, it becomes necessary to use several smaller dump trucks instead of one large one, or, conversely, to carry a few hundred kilograms of cargo on a seven-ton truck, or to process simple small parts on a large, complex machine. All of this wastes labor, metal, fuel and other resources, in both the production and machine utilization spheres.

Well-founded proportions between the production of basic machines and the tools, fittings, attachments, spare parts, power supplies and other items needed for their functioning are extremely important. For example, the scarcity of electric loaders here is well known. However, many of these machines stand idle because of battery shortages. Providing each such loader with three batteries is equivalent to increasing the fleet by one-third, and is also cheaper to do.

Improving the structure of machinery and equipment requires a number of organizational measures. In particular, the services within planning organs and branch ministries which are involved in determining the requirement and rational structure of equipment must be expanded. Why is this so important?

While tens of thousands of specialists are involved in creating new equipment, there are only a few specialists involved in defining requirements, and these only sporadically. At the same time, the requirement must be economically founded, and defined for large groups or types of machines, as well as for types, sizes and modifications. In order to do this, the machine builders must study carefully how the technical parameters are utilized in operation and determine the sphere of rational implication of each machine.

In our opinion, the structure of equipment, in all of its aspects, must become a special object of planning. Perhaps the plans for the machine building ministries could include a number of additional tables containing assignments for directed change in the structure of production and the equipment pool in accordance with demand.

In other words, technically and economically justified proportions of machine composition must first be determined, and then the production of whole structural aggregates must be planned: complexes, sets, ranges, collections. For example, this means producing presses as a unit with automatic manipulators (robots); or "Kirovets" tractors with a set of earthmoving tools. If the machine production plan is increased or decreased for some reason, these changes should encompass all of the elements of technologically related working facilities simultaneously.

Machine systems must become the basis for creating a rational structure for working facilities. However, these must not be combined with individual complexes, lines or installations. In our opinion, machine systems must be developed for entire branches of production and for the non-production sphere: they must encompass all basic and auxiliary processes carried out in the branch. Such systems should consist of subsystems and complexes of machines for individual production.

Machine systems have been developed in many branches, for example agriculture and construction. Nonetheless, they still have not become the basis upon which the production of all needed equipment is planned. It is very important that the branches which produce equipment develop such systems in conjunction with the consumer branches and use them as the basis for programs for technical re-tooling of the corresponding production.

The age structure of the machine pool must also be improved; each branch must plan resources to augment the pool and to determine the amount of equipment to be replaced.

Progress in equipment structure depends to a great deal upon improving the structure of machine building itself and its adaptability to the changing requirements of production and scientific-technical achievements. The effectiveness of the production of such equipment as hoisting, transporting and warehousing, tools and fittings, units, parts and general-purpose blanks is reduced because this production is scattered among tens of branches and thousands of enterprises. Long-standing tasks to form specialized branches to produce hoisting, transport and warehousing equipment and general-purpose articles have not yet been carried out, even though this would make it possible to ensure the required concentration of production of like articles, reduce their prime cost and increase the technical level and degree of standardization.

New structural problems also arise in connection with expansion of the functions of machine building, which under present conditions must undertake increasingly the production of equipment as well as its installation and set-up at customers' locations, repair and modernization, development of control programs and other functions. It is especially important to isolate the production of certain new promising types of technology in independent subbranches. This includes, for example,



industrial robots, heat utilization equipment and equipment to protect the environment.

The problems involved in improving the structure of machine building are complex and multifaceted. In order to solve them, a long-term nationwide plan should be created under the supervision of Gosplan USSR and the USSR State Committee on Science and Technology, with the participation of scientists and specialists. Then the "motley" world of machinery will be enriched in colors and shades, and will be more precisely weighted.

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## METALWORKING EQUIPMENT

### INCREASING RATE OF INTRODUCTION OF TECHNOLOGY

Moscow EKONOMICHESKAYA GAZETA in Russian No 4, Jan 82, p 14

[Article by M. Malinin, deputy minister of Tractor and Agricultural Machine Building "Orders and Refusals"]

[Text] Acceleration of technical progress is an important factor in improving production efficiency. The role of machine building ministries, especially machine-tool, is a major one. This response to the review entitled "Development of Machine Tool Building" (EG, No 33, 1981) discusses its influence on the tractor and agricultural machine building branch, along with unresolved problems and difficulties.

"A number of types of machine tools are obsolescent in terms of metal use, degree of automation and quality of manufacture", according to the review. The 11th five-year plan contains provisions to improve significantly the technical level and competitiveness of metalworking equipment. The enterprises of Minstankoprom have been instructed to develop, manufacture and deliver progressive technological complexes for total working of 14 separate motor and tractor parts (cylinder head, connecting rod, piston rings, etc.).

Time is passing, and no real results can yet be seen. It is true that Minsel'khoz-mash and Minstankoprom have defined the basic composition of the technological complexes and the technical requirements for the equipment, the nomenclature of parts to be produced, etc. Twenty-four orders for technological complexes have been developed and turned over to Minstankoprom for coordination.

However, it was discovered during the coordination process that the machine tool builders are not accepting certain types of equipment included in the complexes for fabrication (for example, systems for collecting and removing chips and for supplying and cleaning cooling fluids).

Is it the case that this equipment is something new? No: the enterprises of Minsel'khoz-mash, primarily motor building enterprises, are using dozens of automated lines which were created in previous years by designers in Moscow and Minsk and built by a number of machine building plants. These are very similar to what are called "technological complexes" in modern terminology.

And now, during coordination of new orders with enterprises and organizations of Minstankoprom, a clear tendency is showing up to retreat from positions which have already been achieved, to pull back. Here are some specific examples as proof.

The Moscow Automatic Line Plant declined to produce, as part of a crank shaft processing complex (ordered by the Voroshilovgrad Crank Shaft Plant), equipment for heat treating, washing and drying articles and for defectoscopy; the plant also declined to deliver a coolant supply system.

The following were omitted from an order from the "Kievtraktorodetal'" Association for a piston processing complex: an automatic adhesion strength tester, an automatic piston preservative-treating and packaging line, automatic equipment for testing combustion chamber seals and for "adjusting" piston weight, as well as certain other equipment.

The machine-tool builders caused their customers (the "Kievtraktorodetal'" Association and the Vladimir Tractor Plant) to be faced with the same conditions in agreeing to deliver technological systems for producing cylinder sleeves, cylinder heads, connecting rods and a number of other parts.

Minstankoprom obviously must take a serious role in coordinating the work of subordinate enterprises in the area of creating technology for processing common tractor and motor parts. It is most desirable that the acceptance and examination of orders for integrated equipment be headed by the technical directorate of the Ministry, or at the delegation of the latter, one of the specialized institutes.

The associations and plants belonging to Minsel'khozmash also need high-precision, efficient equipment. Improving the quality, reliability and service life of machinery depends upon this to a great extent. We are experiencing major difficulties in obtaining this kind of equipment. During 1981-1985 the organizations and enterprises of Minstankoprom are to plan and deliver for production 193 types of precision equipment. Thus far Minstankoprom has agreed on only 50 types.

Our repeated attempts to find a common language with Minstankoprom and to develop a coordinated decision to build precision equipment, including equipment for working basic motor parts, have met with no success. The enterprises of the machine tool building industry are declining to accept the technical requirements of the customer plants; therefore, the coordination procedure is becoming drawn out. The results of the work done with Minstankoprom and the refusal to accept a number of our orders have been presented to the USSR State Committee on Science and Technology. No positive resolution has been forthcoming.

The situation regarding the creation of special machine tools for working a number of important motor parts gives cause for alarm. The existing models of special machine tools needed for mass production of piston rings are not providing improvement in the oil-burning indicator. As a result, the problem of improving engine fuel economy is not being fully resolved.

Only 35-40% of the demand of our branch for special machine tools for working crank shafts and distributor shafts is being satisfied. This is delaying the introduction of new production capabilities at the Ural Mechanical and the Voroshilovgrad crank shaft plant.

The introduction of progressive low-pollution technology, improving the metal utilization factor and obtaining precision blanks are of special importance in tractor and agricultural machine building during the 11th five-year plan. Recall that our branch is also a major user of rolled metal (over five million tons per year). The utilization factor of this metal in fabricating machine parts on existing equipment is still low. A significant amount of the metal goes to waste, primarily chips. A large portion of the blame for this belongs to our ministry. We have done far from everything possible to conserve materials.

Tractor and agricultural machine building workers are obligated to apply maximum efforts in order to achieve more rational metal utilization, but we are within our rights to count on major assistance from Minstankoprom. The nomenclature as well as the amount of forging and pressing machines produced do not correspond to the growing needs of our branch, and the introduction of cold and hot cubic strain processes is being delayed.

There are not enough cold extrusion presses, among others. As concerns the quality of manufacture of automatic cold-up setting combines, it does not meet the stated requirements. These devices have poor performance indicators.

The production of energy-efficient tractors, economical engines with increased power, high-output combines and other agricultural equipment will increase during the present five-year plan. Minstankoprom must participate more actively in resolving the problem at hand.

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## METALWORKING EQUIPMENT

### PLANNING INDICES IN MACHINE BUILDING DISCUSSED

Moscow EKONOMICHESKAYA GAZETA in Russian No 10, Mar 82 p 6

[Unsigned article "On Planning Indicators in Machine Building"]

[Text] The MVK [Interdepartmental Commission] Bureau of Gosplan USSR has examined the matter of improving planning indicators and evaluating the activity of machine building enterprises. It is noted that a number of departments of Gosplan USSR and machine building ministries are not satisfying section 9 of the 12 July 1979 decree of the CPSU Central Committee and the USSR Council of Ministers to make the necessary changes in the system of full-scale indices of output production based on the widespread use of scientifically founded technical and economic indicators which make it possible to consider the efficiency, quality and other consumer properties of products.

Measurement in tons has been retained for many types of products, which does not assist economical management. Some ministries have not made the transition to planning the production of equipment in expanded nomenclature using units of measurement which reflect its productivity and other economical properties more fully.

Many machine building enterprises continue to manufacture products which do not meet current demands. The machine building ministries and Gosstandart USSR are not taking the necessary measures to re-examine obsolete standards for machines and equipment in order for new standards to include, along with other quality characteristics, requirements which will ensure reducing the weight of articles, reducing fuel and energy consumption during their operation, as well as standardizing parts, units and devices.

The measures provided for in the decree concerning restructuring the work of scientific research, design, research and design and technological organizations are being implemented slowly. The role of orders (agreements) in the cost accounting system is not being increased sufficiently. Workers in these organizations are being awarded without the necessary consideration of the overall economic effect actually obtained in the national economy from using the achievements of science and technology. For example, a considerable portion of the award funds in Mintyazhmash, Minavtoprom, Minenergomash and Minsel'khoz mash has been created independent of the economic effect on the national economy. Scientific research, research and development and technological organizations are slow in switching

over to the system of calculation for completely finished work which has been accepted by the customer.

MVK has accepted a number of recommendations aimed at improving the system of planning indicators and economic incentive for machine building production.

The consolidation department for machine building and inter-branch production, other machine building departments, and the department for improving planning and economic incentives of Gosplan USSR and NIIPiNu of Gosplan USSR, with the participation of the machine building ministries, have been given the assignment of accelerating work to improve the indicators for the production output plan in natural expression and to report the result to MVK by 15 April 1982.

6900

CSO: 1821/102

## METALWORKING EQUIPMENT

### 'BULAT-2UZ' COATING APPLICATOR

Moscow EKONOMICHESKAYA GAZETA in Russian No 1, Jan 82 p 16

[Unsigned article: "Cooperation Helped"]

[Text] Creative cooperation between scientists at the Khar'kov Physical-Technical Institute of the UkrSSR Academy of Sciences and specialists at the "Ukrorgstankin-prom" Institute has led to the development of industrial technology and the "Bulat-2UZ" installation. This innovation is designed to apply wear-resistant coatings to cutting tools. As a result, the wear-resistance of the articles is tripled. Three "Bulat" installations have been built and introduced at the Khar'kov Tool Plant. The annual savings from their use amounts to 3 million rubles.

6900

CSO: 1821/103

## METALWORKING EQUIPMENT

### DIMITROV AVIATION PLANT TO INSTALL ROBOT-OPERATED MACHINES

[Editorial Report] Tbilisi KOMUNISTI in Georgian on 16 March 1982 page 3 has a 400-word Gruzinform report on the successful operation of a "robot-manipulator" which runs a digital-program-controlled metal cutting machine in the Dimitrov Aviation Plant's shops. The robot was designed by scientists at Georgian Polytechnic Institute in collaboration with the plant's personnel. It picks up a billet, places it on the machine, punches the button to start the process, removes it and puts it in the bin. The process takes 10 to 15 seconds longer than a human operator, but a robot can do a month's output in 10 days. Plans call for installing a whole line of such robots. A scientific-practical conference was held recently to discuss robotics and ways to coordinate research and development in Georgia.

CSO: 1813/726

END



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**DATE FILMED**

June 4, 1982